On Gamification

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Games have become a popular media. As a consequence, they have been studied extensively to see what it is about them that interests people. A phenomenon called gamification has risen, which tries to bring about the same kind of reactions games do. Gamification is about using game design elements in non-game contexts, for a specific purpose. Games can invoke a flow mind set, which is ideal for optimal performance. This thesis examines what gamification is about, and how to gamify applications. A small case study is presented, in which a gamified system is created and the lessons learned from it are discussed.

Keywords: gamification, motivation, fun, games, play, microwork, games with a purpose.

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1. Introduction

Games have become ever more popular way to spend free time. The majority has heard of games like Angry Birds and Farmville, for example. There has been a lot of research on why games interest people so much, and different parties want to tap into the power of games in order to pursue their own goals. This is how a phenomenon called 'gamification' has risen to be a trend in recent years. Gamification is about using game design elements in non-game contexts [Deterding et al., 2011]. These contexts are, for example, schools and workplaces.

Successful examples of gamification include, for example, Foursquare [2013], a location-based service that allows people to notify where they are and see where their friends are, and Stackoverflow [2013], which is a question and answer forum for programmers. Both services have gathered a large user base. Inspired by the success of some gamified services, companies like Microsoft and Google have tried out using gamified systems to get some work done. For example, Microsoft created Language Quality game [Williams and Smith, 2009], which allowed Microsoft employees all over the world to review the widely translated operating system in their own language. Google presented the Google Image Labeler [von Ahn and Dabbish, 2008], a game that got people to label images and thus help the search engine give more accurate results.

This thesis examines what gamification is and how to gamify a system. The emphasis is on enterprise, and microwork related gamification. A system used for work is gamified as a case study, and the lessons learnt from the process are discussed.

There are seven chapters overall. Chapter 2 discusses games and game design in general, and what gamification can learn from it. Other types of games with purposes beyond entertainment are also introduced here. Chapter 3 introduces games with a purpose (GWAPs) [von Ahn and Dabbish, 2008], which are very similar with our case study to be introduced in Chapter 6. Chapter 4 looks into the psychology behind games and the motivational design behind them. There is also discussion on employee motivation. Chapter 5 tells more about gamification, why it has raised interest and what kind of benefits have been seen. There are also several examples of different types of gamified systems and discussion about the limitations, possible issues, and risks in gamification. Chapter 6 discusses the case study by introducing the type of work to be gamified and what kind of system was created. Chapter 7 discusses what was learnt and what kind of conclusions were made.

2. Games

Games are quite versatile in nature, which is why it might be difficult to define what games are. Juul [2005] has given the following technical definition: *"A game is a rule-based system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels emotionally attached to the outcome, and the consequences of the activity are negotiable"*. Koster [2004] and Bernhaupt [2010] point out, that the game rules are accompanied by a story, which gives meaning to the actions. It is also important to bring up that the player abides by the rules of the game voluntarily [Suits, 2005]. Otherwise, the player wouldn't be playing the game - he or she would be cheating. Examples of traditional video games are SimCity 3000 [1999], Grand Theft Auto IV [2008] and The Witcher 2 [2012]. Sports like basketball, ice hockey and dodge ball are also games. Board games like Monopoly and chess are games. Games have many different forms and contexts, and almost anything can be turned into a game. One could even say life is a game, if the discussion was taken to a more philosophical level; "*A game is a series of meaningful choices*" - Sid Meier.

The difference between games and real life can be explained with the concept of a magic circle. The magic circle of play represents the physical or virtual boundary between games and real life. The magic circle was introduced by historian Huizinga [1955]. Within the magic circle, the player follows the rules of the game instead of the rules of the real world. For example, when playing football, the player stays physically on the field. When playing a video game, the player follows the rules of the virtual world of the game. This means that the player is in a virtual environment (both in football and while playing video games) he or she finds meaningful.

Games are primarily used for entertainment at home, but there are also serious games [Abt, 1970] that are played for other purposes, such as learning. Pervasive games bring games to new contexts, situations and spaces, which means they break the 'magic circle' of play spatially, temporally or socially [Montola et al., 2009]. Another sub-category of games are 'games with a purpose' (GWAPs) that distribute small microtasks to random players who complete these microtasks [von Ahn and Dabbish, 2008]. These microtasks are tasks that an artificial intelligence (AI) cannot handle, but humans are very good at, such as interpreting images. GWAPs are basically a certain type of gamified systems, since they incorporate game elements to non-game contexts.

Section 2.1 briefly looks at game design in general, in parts where it is relevant for gamification. Section 2.2 introduces a hierarchy of game elements from game mechanics to dynamics. Section 2.3 introduces activity loops, and Section 2.4 talks about different player types. Section 2.5 contemplates the difference between games, play, and fun. Finally, Section 2.6 goes more in-depth into games beyond entertainment by introducing serious games, pervasive games and productivity games.

2.1. Game Design

Game design and gamification design are slightly different, so they are handled in different sections. This section is about understanding the basics of game design in order to use it for gamification design.

When thinking about designing a game, one starting point is to think about the 'player journey'. In other words, what it takes for the player to start playing and keep on playing, and finally reach mastery in the game. Onboarding is used to get the new player into the game as quickly and easily as possible. Scaffolding is used to help the player to learn to play the game [Zichermann and Cunningham, 2011]. The skill accumulated with the help of onboarding and scaffolding will help the player to reach a point of mastery in the game. When the players are learning and progressing, they are more likely to find it fun and keep on playing.

Onboarding and scaffolding can include direct guidance to the player via a tutorial or visual cues, like flashing an object of interest. There can be direct feedback to reinforce that the player did the right thing. The game can have limited options initially to simplify it and make it easier. It is also usually impossible to fail the first stage or segment of the game. Very often the game world is limited and simplified in the beginning, and starts to widen and get more complex as the player progresses. There are also difficulty levels ranging from easy to especially difficult for different kinds of players. After onboarding and scaffolding it is important to keep difficulty balance in the game. It cannot be too hard (the players get frustrated) or too easy (the players get bored). Maintaining the balance may be hard and requires play testing and multiple iterations.

One important aspect of game design is creating an experience. This is usually done with visuals, audio or storytelling, i.e., creating a virtual world. The experience is what makes the game meaningful to the player. Creating the right kind of experience can be seen as the creative side of game design.

2.2. Game Elements

Games can be broken down into game elements that make up the games. These game elements can be further split into higher level and lower level elements.

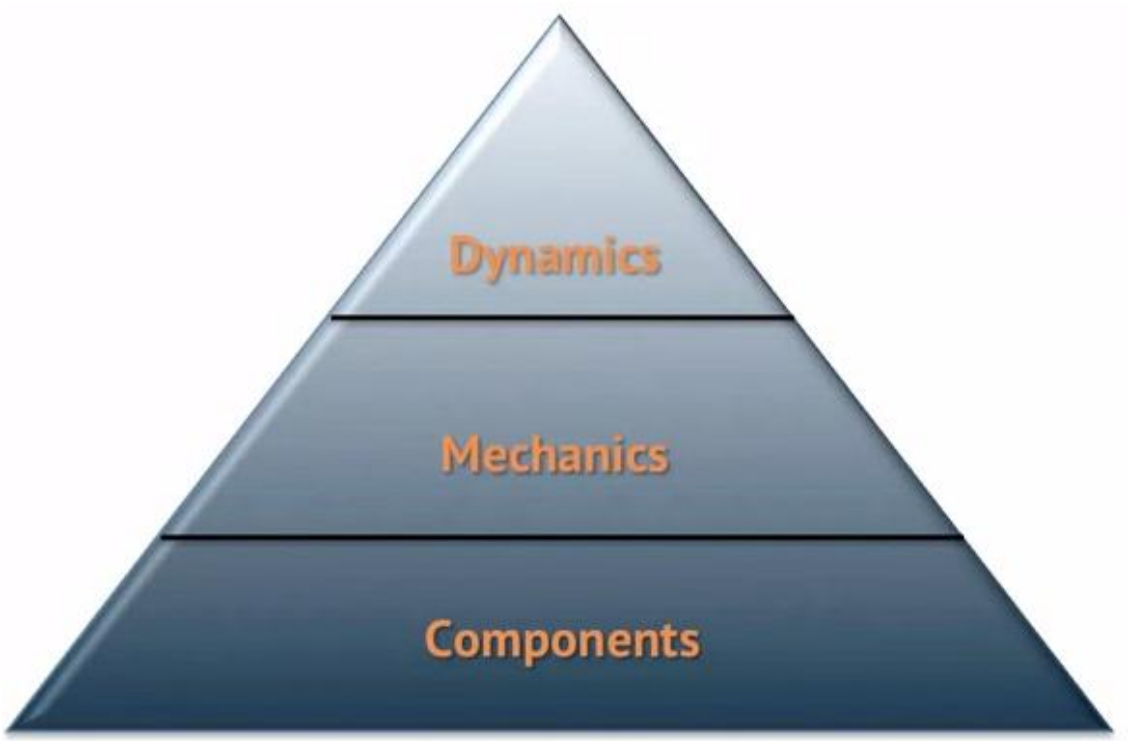


Figure 1: Hierarchy structure of game elements [Werbach, 2012].

A hierarchical pyramid representation of game elements is shown in Figure 1. Game elements can be broken down to dynamics, mechanics and components, dynamics being the highest level elements and components the lowest level game elements [Werbach, 2012]. These elements with an overall user experience make up a game. The user experience is made partly with aesthetics, like visuals and sound.

Game dynamics are the most high-level game elements. They pose the “big picture”, the implicit structures of the game, of which the rules may be manifestations. Dynamics can be considered the 'grammar' of game elements. Examples of game dynamics are constraints, emotions, narrative, progression and relationships. For example, constraints limit the players’ freedom, which creates basis for creating meaningful choices.

Game mechanics in the middle tier are elements that drive the action forward in a game. Mechanics can be seen as 'verbs'. Examples of game mechanics are challenges, chance, competition, cooperation, feedback, resource acquisition, rewards, transactions, turns and win states. For example, challenges give some goal for the player to reach and chances means there is luck involved.

Game components are in the bottom tier. They are the specific instantiations of game dynamics and mechanics. Components can be seen as 'nouns'. Examples of game components are achievements, avatars, badges, boss fights, collections, content

unlocking, leaderboards, levels, points, quests, virtual goods and so forth. For example, badges represent achievements and virtual goods represent objects in the virtual world. Lower level components may implement more than one higher level mechanics and dynamics.

Subsection 2.2.1 will discuss the most used game elements both in games and gamified systems, and Subsection 2.2.2 will contemplate the limitations of these elements.

2.2.1. Points, Badges, and Leaderboards

There is a group of game elements, called Points, Badges, and Leaderboards (PBL), that has been used extensively in games and gamified applications. These elements are interesting to gamification designers, because they have so much variety.

Points are generally used as rewards and for giving feedback. Points can represent anything, and they are all the same, which is why they are used extensively. A point can be a prize itself, but very often points cumulate towards a prize. Both players and game designers can benefit from the feedback points give [Werbach, 2012]. For competing players, points are a way of score keeping and defining winning states. Outside competitive setting, points can be used to show the player his or her progress in the game, for example, points can cumulate towards level thresholds. Game designers can improve the game based on the feedback. For example, if the players are accumulating points too fast, the game is probably too easy.

Badges are representations of achievement, as mentioned earlier. Badges are flexible like points, they can be used to represent anything. A badge can look like anything, which is why it can convey the style even for the entire gamified system. They can also be used to signal what things are important in the game or gamified system. Badges can also act as credentials, they signal the achievements of the player to others. Badges support collections. Finally, because badges show credentials to others, they are also status symbols.

Leaderboards are used for ranking players relative to other players. They provide feedback on competition. This is a controversial game component, because it doesn't suit more collaborative players. It can also demotivate from playing the game altogether, if the highest scores are too high. Suppose, player A has a score of 500 and player B has a score of 25 000 000. Player A won't feel that good about his or her score and possibly gives up on playing. This is why there are also personalized leaderboards, which show the player's goal in the middle, and a few higher scores, and a few lower scores. That way the player feels like he or she is doing good in the game. A variant of personalized leaderboard is friend-relative leaderboard that shows two friends above the player, and two down. Then they tell what the player has to do in order to beat a friend in a higher place. This brings a social aspect and more fun into play when the player gets to compete with people he or she knows.

2.2.2. Limitations of Elements

Elements themselves do not make the game. It is the experience combined with the elements. Although gamification, by definition, is about adding game elements to non-game contexts, they do not bring the 'magic of games' with them by themselves.

Another limitation concerns mainly PBL's. When using points, badges and leaderboards, rewarding is emphasised. To sum up the issue with rewards: "*not all rewards are fun; not all fun is rewarding*" [Werbach, 2012]. Rewards can even demotivate people from doing things, or doing them well, especially if the system relies solely on rewards.

Making a service based on PBL's will make it look like any other service. It will also frustrate the users, because they've already seen many sites like it and most likely don't want to go through collecting badges in every site they visit. The novelty will wear out soon as well, if the sites don't offer anything different and meaningful.

It is important to think whether the service provides meaningful choices, puzzles (efforts, challenges, problem solving), mastery, community, and does it serve different kinds of users.

2.3. Activity Loops

Games are designed around activity loops. For example, a program checking for a key press is an activity loop that is broken by a key press, which fires another action. Engagement loops are based on the scenario, where a character has a motivation to do something, the motivation leads to action, and the action produces feedback. The feedback may motivate another action, which again produces feedback. For example, the player is motivated to do something, like - vanquish a foe. If the motivation is strong enough, an action occurs (like vanquishing the foe). The player receives feedback for the action, which, in turn, acts a motivator to do something else. In gamification and games, the engagement loop needs to be constructed.

Progression loops look at a wider picture, rather than individual actions and motivations. Progression loops go from start to finish, in a series of intermediate steps. This is like the player journey from novice to master.

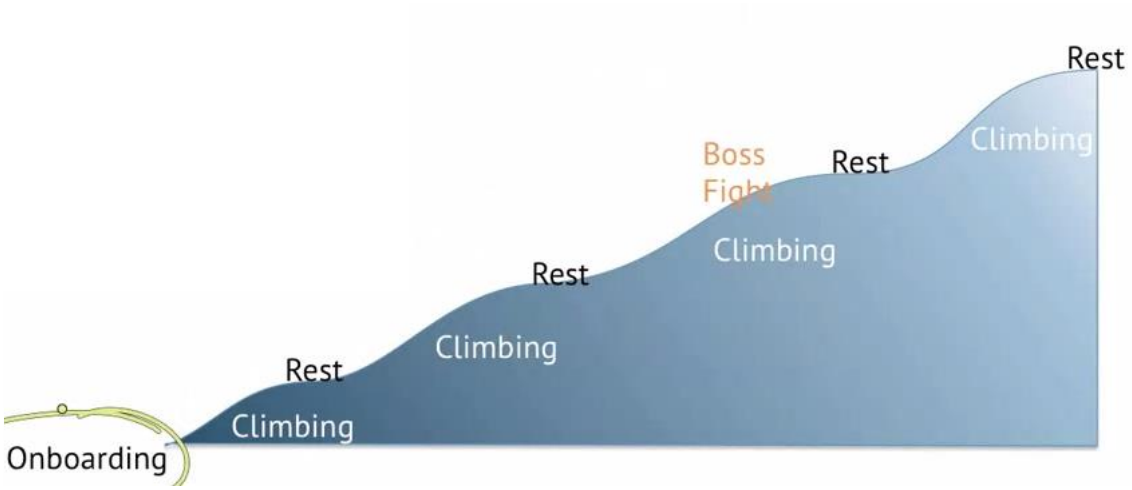


Figure 2: Player journey [Werbach, 2012].

The player journey is represented in Figure 2. It starts with onboarding, which gets the player in the game, then there's some challenge, resting, and challenge, until a boss fight is reached. The boss fight is a tougher challenge, after which the player usually gets into another segment/level of the game. It also gives the opportunity for real accomplishment and demonstration of what the player has learned.

2.4. Player Types

Players can be roughly categorized into killers, achievers, socializers and explorers, as presented in Figure 3 [Bartle, 1996].

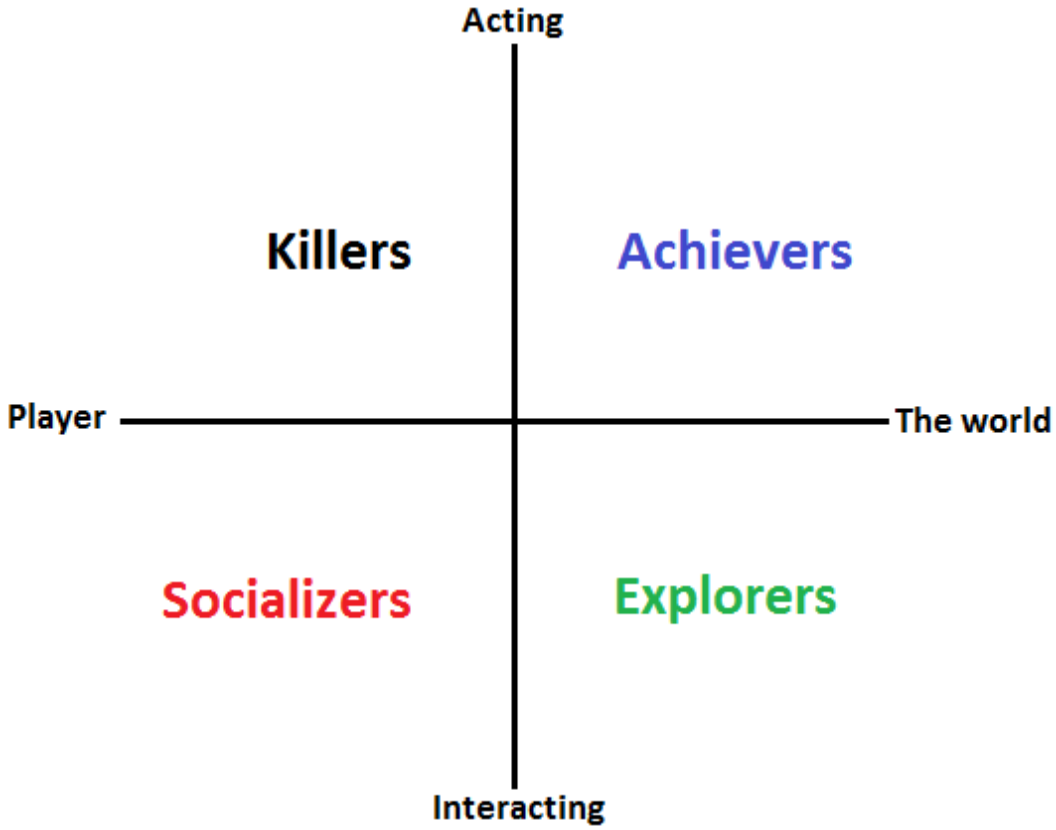


Figure 3: Bartle's player types [Bartle, 1996].

Achievers want to do some action in the world the game creates and get recognition on that achievement. Explorers want to see what's possible in the world. People who want to interact with the players as opposed to the world are socializers. Killers are like achievers, but they feel the need to triumph over others. These borders are fuzzy and players cannot be categorized into just one or two segments.

Kim [2012] has made a different version of the player types (represented in Figure 4), as she finds Bartle's player types do not work for casual, social and serious games and gaming systems. She has created 'social engagement verbs' to capture the motivational patterns in what she sees in modern social gaming and social media. These verbs are: compete, collaborate, explore, and express. Competing is similar to Bartle's achievement. Competition drives social gameplay and self-improvement. Kim sees that competition is not often the best motivator, especially for female players. Collaborate is much like Bartle's socializer. Kim sees that collaboration and collective action are one of the most influential driving forces, take Wikipedia for example, which is a monument to crowdsourcing (collective action). Explore is identical to Bartle's explorer. Explorers are motivated by information, access and knowledge. Express replaces Bartle's killer. Self-expression is a key driver for modern social gaming and social media, and a motivator for engagement and purchases/monetization. People who express themselves are motivated by gaining a richer palette and greater abilities to showcase their creativity and show who they are.

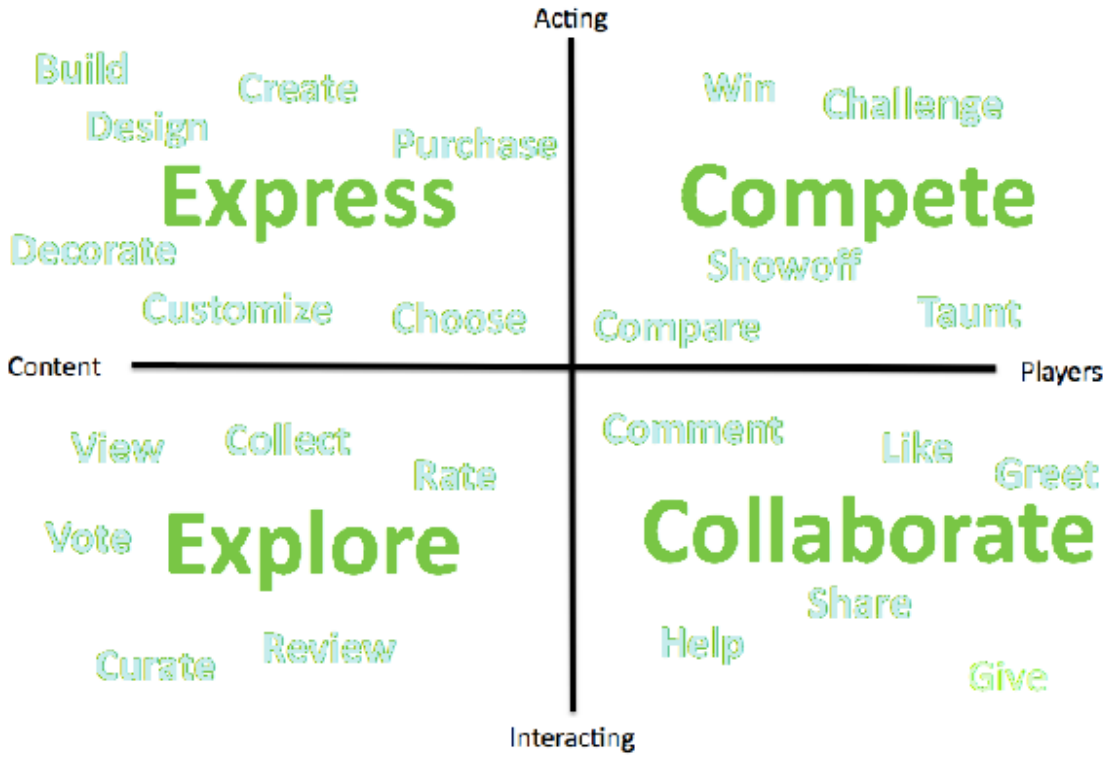


Figure 4: Social engagement verbs for casual, social and serious games and gaming systems [Kim, 2012].

2.5. Games, Play, and Fun

Play has been defined as ”*whatever is done spontaneously and for its own sake*” by George Santayana and ”*free movement within a more rigid structure*” by Salen and Zimmerman [2003], among other definitions. Play is having exuberant energy and doing something just for fun. Games and play are connected, but they are not the same.

There are three things gamification can learn from games and play [Werbach and Hunter, 2012]. First, playing is always voluntary, if one must play, they cannot play, as stated by Carse [1987]. Second, games involve learning and problem solving. Third, there has to be a balance of structure and exploration. If the game is too structured, it's going to feel too constrained. If it is too unstructured, the player won't get ahead and feel like he or she cannot progress.

Fun is the reason people play games. Hence, it is important to understand what fun means, and why well designed games are fun. With regards to gamification, it is important to think about how to make the gamified application fun. In the words of children's tale character Mary Poppins: “*In every job that must be done, there is an element of fun. You find the fun and snap! The job's a game”*.

One way to approach an understanding is by thinking what kind of things are fun. Winning is fun. Also, overcoming obstacles thus achieving something is fun, even if it doesn't include winning, the activity itself is fun. Exploring is fun, it is nice to find new things. Just hanging around, relaxing can be fun as well. Successful team work is fun, because human beings like to collaborate and work together to achieve a goal. Recognition is fun, too, it's good to feel appreciated. Triumphing can also be fun, it's like winning, with the notion that someone else lost. To continue the list, collecting, e.g., stamps, is fun. Surprises are usually associated with fun. Using one's imagination, daydreaming can be fun. Being altruistic, i.e., sharing, is fun. Role playing, pretending you're someone else, is perceived as fun, too. Customization, making something of your own, is fun. Finally, just goofing off is fun, just being silly. Basically, very many different things are fun. It doesn't necessarily involve laughter, it's just something that creates a positive emotion.

Gamification is about finding the fun in the goal it's trying to achieve. Be it labelling images or completing a profile page. Fun, the positive psychology behind it, is viewed more closely in Chapter 4, which tells more about the psychology behind games.

2.6. Games Beyond Entertainment

Games are not generally seen as part of the work place or other contexts that are perceived as serious, like schools. Even still, there are many examples of game concepts that have been in use in 'serious contexts' for a long time. Especially in marketing, there are often monthly sales competitions to boost motivation. Competition relates to a game concept of challenges. Frequent flyer program tiers relate to levels. Weight watchers' group relates

to concept of teams in games. “Buy two, get third for free” -marketing relates to rewards, and getting a membership card to some store is like a badge. Gamification applies the already existing game concepts in a more systematic way than before.

Gamification is a part of serious games, which are introduced in Subsection 2.6.1. Subsection 2.6.2 introduces pervasive games, the kind of games gamified applications can be. Subsection 2.6.3 introduces productivity games, which are examples of enterprise gamification.

2.6.1. Serious Games

Gamification can be seen as a form of serious games, which are used for other purposes beyond entertainment. Serious games simulate real life processes [Abt, 1970]. The term was first used by Abt, who proposed that games can be used for education. There is a conflict between teaching abstract thoughts and ideas to students, who often cannot see what use they are in real life. Games can combine the abstract thought with the action.

Games can be used to model all purposeful human activities, which involve participants, rules and procedures. If you consider the words amusement, sport, procedure, gain, activity, competition, participants, moves, winning, losing, play, and spirit – which are all part of everyday life, pretty much all describe the formal structure of games; procedure, rules, participants, information, rules, and so forth. Abt [1970] defines a game as an ”*activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context*”.

Education, industrial and governmental training, planning, research, analysis and evaluation are all suitable fields for the use of serious games. For example, the government can use games to test alternative military strategies or to evaluate regional transportation plans. In industry, games can be used to train management in complex decision making. Games provide a means of identifying and evaluating the consequences of alternative plans and policies. For example, an engineer makes a model of an airplane and tests it in a scaled down simulated environment before building one. In essence, serious games combine the seriousness of thought and problems that require it with the experimental and emotional freedom of active play.

2.6.2. Pervasive Games

Pervasive games combine virtual game worlds with elements of the real world [Montola et al., 2005]. Pervasive games break the magic circle of games spacially, temporally, or socially. In other words, these games try to blend into our everyday lives. Unlike in traditional games, the playing time and place are uncertain and changing. Pervasive games can even involve non-players in the game without them knowing of it.

Pervasive games are based on ubiquitous computing. Ubiquitous computing means that computers become part of the everyday objects and integrate into the environment. A class of ubiquitous games exists as well, but what separates them from pervasive games

is that they usually are more part of the real world. While real world elements are brought to the virtual game world in pervasive games, in ubiquitous games the game features are brought to the real world. Gamified systems that break the magic circle can be considered ubiquitous games. For example, there is a gamified toothbrush that brings game elements to the real world by giving points for brushing teeth [Beamtoothbrush, 2013].

2.6.3. Productivity Games

Williams and Smith [2009] coined the term productivity games, to describe games that are designed to increase productivity through the use of game elements and engaging game play. These games can be seen as a sub-category of serious games. Play is a part of being a human being, and it can help people to come together, have fun, and work together to accomplish tasks. Play occurs often in the context of games. Brown [2009] highlights the essential roles of trust and community in play. Therefore, games can be seen as a good way to encourage participation.

Productivity games and GWAPs are basically the same, but they are discussed in different sections to make a difference between enterprise gamification and gamified crowdsourcing. Productivity games focus on using organization's own employees, while games with a purpose use crowdsourcing.

Figure 5 shows in what kinds of situations gamification could fit in an organization [Williams and Smith, 2009].

	core	unique	expanding skills
in role behaviour			most impact
organizational behaviour	most impact		

Figure 5: Gamification in enterprises [Williams and Smith's, 2009].

Core skills are skills everyone in the organization has. Unique skills are limited to a particular employee or a group of employees. Future skills are skills that an employee would like to obtain. There are two types of gamification in an enterprise: getting community to achieve a common goal, and improving individual's work environment and performance. For communities, gamification needs to be outside in-role behaviour in order to work, to create a level play field for all. Games which encourage good corporate behaviour, but rely on core skills that all users share, are the most valuable space for productivity games. Additionally, because behaviour is not closely linked to any

individual's job, no-one's employment is threatened by the success of another team member [Williams and Smith, 2009].

Games that help to improve work performance can be linked to in role behaviour and expanding skills. Employees are usually willing to learn new skills in order to make their job easier, so learning games could fit in an organization well. These learning games could help employees teach their co-workers as well. Learning games can also be used to test what has been learned within the context of play.

Games do not fit the organization, when they fall into in-role behaviour and core or unique skills. This would be someone's job. It would be very limiting, because not all could participate in the game. Also, if someone plays better than the person whose job the game is about, the beaten person might feel insecure about his or her job later on. Additionally, there might be awkward situations with performance reviews and competitive in-role games.

The use of productivity games in enterprises could be beneficial, because games have given gamers certain expectations. Games teach that the cost of failing is very low and it is always possible to retry. There is always clear feedback as to what needs to be changed in order to succeed later on. Especially the younger generation values a clear feedback loop and transparency in the consequences. Games are always expected to be fair, otherwise they won't be played. The gamer generation expects the workplace to have the same kind of transparency and a clear feedback loop. They also expect fairness in how they are treated and in how they should treat others. Finally, games use onboarding and scaffolding instead of lengthy manuals to teach. Similar approach would work better in the workplace [Williams and Smith, 2009]. Productivity games help to meet the expectations of the 'gamers', when they are properly designed. When these things are in place, employees will be more engaged, motivated and productive. It is noted, that there can be a conflict between primary reward system (paycheck) and secondary reward system (game rewards), but these conflicts can be overcome, if the game is designed well and is motivational enough.

3. Games With a Purpose

Games with a purpose (GWAPs) [von Ahn and Dabbish, 2008] are games, in which people perform tasks computers are unable to do, as a side effect of playing.

Some of the earliest examples of work online are open source software development projects, dating back to 1960's. A much later similar example is Linux. Another example is the user generated encyclopaedia Wikipedia. These two are also examples of crowdsourcing; outsourcing tasks to a distributed group of people [Howe, 2006]. The common feature of these tasks is that, doing them alone or in a small group would be too difficult and time-consuming. A service called Amazon Mechanical Turk has been launched in 2005 to deal with these kinds of tasks. It splits large computational tasks into smaller chunks and divides them among a group of people willing to complete small amounts of work for minimal amount of money. These tasks are called human intelligence tasks (HITs).

Another example related to GWAPs is the Open Mind Initiative [Stork, 1999]. It is a worldwide research endeavour developing intelligent software by leveraging human skills to train computers. Regular Internet users participate by providing answers to questions computers cannot answer, such as “what is in this image?” The Open Mind Initiative relies on the willingness of unpaid volunteers to donate their time without knowing if the information they enter is correct. GWAPs differ from this in a way that they are designed to be entertaining while ensuring that the collected data is free from errors.

The GWAP approach is motivated by three factors: (1) more and more people are getting access to the Internet, (2) some tasks are almost impossible for computers, but easy for human beings, and (3) people spend a lot of time playing games [von Ahn and Dabbish, 2008]. The approach doesn't rely on altruism or financial incentives, but on human wish to be entertained.

Section 3.1 introduces different kinds of GWAP templates and Section 3.2 tells a little more about output-agreement games, which is one of the GWAP templates.

3.1. GWAP Templates

GWAPs can be divided into output-agreement games, inversion-problem games, and input-agreement games [von Ahn and Dabbish, 2008]. Output-agreement games are set up so that two strangers are paired among all potential players. The game consists of rounds, where the randomly determined pair gets the same input and the players must produce outputs based on the input. They should try to produce the same output as their partners. The winning condition is met, if both players produce the same output. The players cannot communicate and know nothing about each other, so the only way to produce the same output is by entering something related to the common input. When the players provide the same output, it partly verifies the result is correct, because it comes

from two independent sources. An example of an output-agreement game is given in Chapter 5.

Inversion-problem games are set up by randomly making pairs the same way as in output-agreement games. In each round, one player is assigned to be the 'describer' and the other as the 'guesser'. The describer gets an input. Based on the input, the describer produces outputs that are sent to the guesser. The outputs of the describer should help the guesser to produce the original input. The winning condition is met if the guesser successfully produces the input that was given to the describer. If the description is incorrect or incomplete, the guesser won't be able to make the right guess. Therefore, the game structure encourages players to enter correct information.

Input-agreement games are set up like the previous, by pairing players. In each round, both players are given inputs that are known by the game (but not by the players) to be same or different. The players produce outputs describing their input, so that their partners are able to assess whether their inputs are the same or different. Players only see each other's outputs. The winning condition is met if both players correctly determine whether they have been given the same or different inputs. The game structure encourages players to want to help their partners to determine if the inputs are the same. This means they will give accurate outputs that describe their inputs. To discourage people from just guessing, wrong guesses are strongly penalized.

3.2. Output-agreement Games and Quality of Labels

Von Ahn and Dabbish [2004] provided three criteria to judge that the ESP game can collect labels with high quality. First, the labels collected by the game describe at least parts of the image. Second, at least 83% of the labels for each image generated by paid workers were covered by the labels collected from the game. Third, 85% of the labels collected from the game would be used to describe the image by other independent participants. These criteria have been challenged by Robertson et al. [2009], who built a robot that generated labels without any knowledge of the images. Instead, this robot only used the words that were already used to label the images, and used a language model to generate labels to play with other human players online. The result showed that the robot generated many labels that matched human players and thus earned high points. However, given that the robot apparently could not assign high quality labels without knowledge on the images, high agreement between players clearly did not imply high-quality labels. In fact, Robertson et al. [2009] used their results to argue that players in the ESP game usually produce obvious labels in order to match other player’s labels, rather than high-quality labels that provide useful information about the images. Results of the study suggest that incentives that motivate players to reach high-agreement does not necessarily lead to quality labels.

Huang and Fu [2012] looked into the effects of the gaming environment, social interaction and feedback on output-agreement games. They asked how and why GWAPs affect the quality of the labels, for example, in the ESP game, and how GWAPs can be designed to increase the motivation for players to label the data. Huang and Fu [2012] separated output-agreement games into three different components; gaming environment, social interaction and feedback. The gaming environment is the scoring system that rewards players who generate the same output. The main purposes of the gaming environment are: (1) creating a fun environment for players to label the data while enjoying the game, (2) encouraging players to generate agreed answers as much as they can, and (3) motivating players to engage in the task to generate high-quality outputs [Huang and Fu, 2012].

Social interaction occurs, because players are paired. Even though they cannot communicate, their score depends on each other. This creates a feeling of social interaction. Players also learn about each other based on each their outputs. The feedback is implied in the gaming environment and social interaction. The gaming environment tells whether a label has been agreed on. The social interaction provides feedback on each other's answers, e.g., a player notices that his or her partner seems to describe background objects, while the player focused on foreground objects. The players have to change their strategy to win.

Huang and Fu [2012] created an output-agreement game that was meant to compare sentence-pairs and determine whether they were semantically the same or not. For the purposes of testing, they made five different interfaces:

1. The baseline, which only included the task at hand.
2. Labelling with feedback, which differed from the baseline so that the worker got to know whether his or her replies were the same or different as another randomly selected worker's in the past.
3. Labelling with feedback and social interaction, which was the same as labelling with feedback, but it created the feeling that the worker was working with a pair at the same time.
4. Labelling with feedback in a gaming environment, which brought in the game rules. It included a scoring system and a leaderboard with top five players.
5. Labelling with feedback and social interaction in a gaming environment had all the previous combined.

A high-quality label was the one that differed only slightly from predetermined results. Labelling with feedback in a gaming environment provided the most high-quality labels, the baseline the least. Feedback and social interaction did not significantly improve the ability to collect high-quality labels. A questionnaire after the study asked if the workers would do it again without monetary reward. It turned out that most would do it in the case

of social interaction [Huang and Fu, 2012]. This means that social interaction in an output-agreement game is a significant way to attract voluntary workers.

3.2.1. Microwork

Microwork is the kind of work that can be divided in small tasks. Usually microwork is something that would be done by computers, if they were good at it. However, there are tasks the computer is not good at, for example, interpreting images or translating texts. GWAPs are often based on microwork, like the Google Image Labeler. Microwork is also often crowdsourced, just as in the labeler game. Gamification suits microwork very well, because people usually don't do anything work-like for free and on their spare time. Of course, offering a little bit of money is possible, but the crowd can be motivated by making the process fun (with gamification) as well, or by appealing to something they care about, like helping to digitize national archives.

There are types of microwork that can be done for money. For example, Amazon Mechanical Turk is an online labour market where workers are paid small amounts of money for small tasks. Workers are recognized by their unique id. The task provider (or requester) forms a group of human intelligence tasks (HITs), each of which is a form composed of an arbitrary number of questions. The user requesting annotations for the group of HITs can specify the number of unique annotations per HIT the task provider is willing to pay for, as well as the reward payment for each individual HIT. This is done to guarantee that annotations are collected from unique accounts. The requester can limit who can perform tasks by requiring a particular set of qualifications, like sufficient accuracy in a small test set. Workers may then annotate the tasks of their choosing. When the work is done, the requester has the option of approving the work and optionally giving a bonus to individual workers.

Snow et al. [2008] evaluated whether the non-expert annotations are good enough by comparing them to expert annotations, to determine if it's reasonable to use Amazon Mechanical Turk. They concluded that only a small amount of non-expert annotations per item are necessary to equal the performance of an expert annotator.

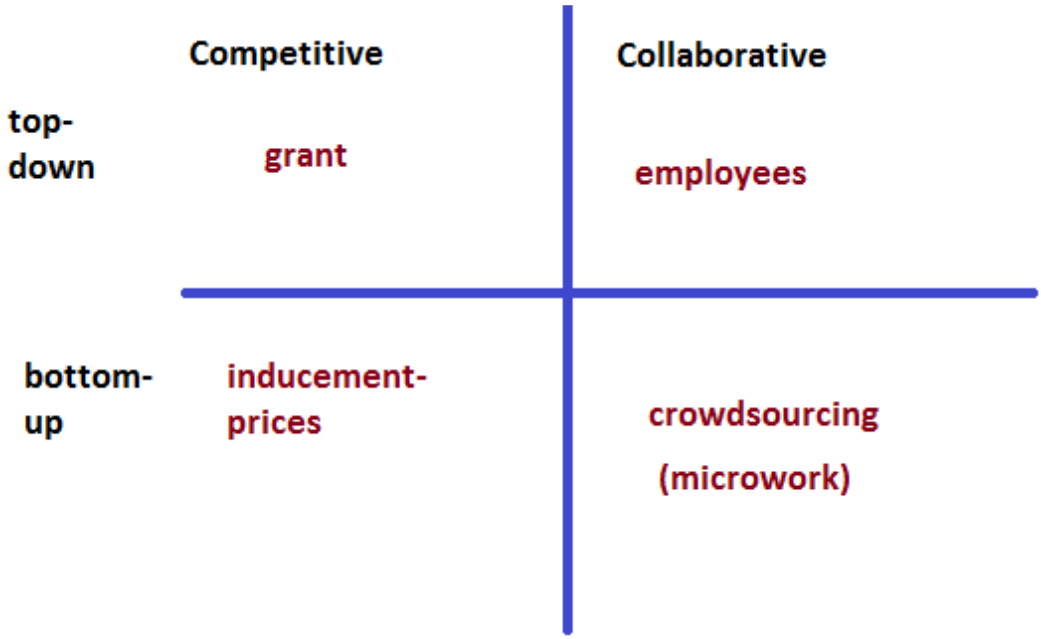


Figure 6: Segments where different type of work or motivation to work is.

Microwork is collaborative work, which can be placed in the bottom right segment of Figure 6, which separates different ways of getting work done. On the top right, employees segment, is the most common way to get work done. Enterprises hire employees to do the job, and the employees receive monetary rewards for their efforts. Crowdsourcing in the bottom gives anyone the chance to do work, which can be paid or not. Both segments on the right are collaborative in nature, workers work together to achieve common goals. Grants and inducement prices are competitive, because people compete to gain them.

3.2.2. Measuring the Success of GWAPs

Von Ahn and Dabbish [2008] provide some metrics to measure GWAP success. These metrics are throughput, lifetime play, and expected contribution. The throughput of a GWAP is the average number of problem instances solved, or input-output mappings performed, per human hour. This is calculated by examining how many individual inputs, or images, are matched with outputs, or labels, over a certain period of time. Learning curves and variations in player skill must be considered in calculating throughput. Most games involve a certain type of learning, meaning that with repeated game sessions over time, players become more skilled at the game. To account for variance in player skill and changes in player speed over time as a result of learning, throughput is defined as the average number of problem instances solved per human-hour. This average is taken over all game sessions through a reasonably lengthy period of time and over all players of the game. Enjoyability is a bit more elusive to measure, so counting the average lifetime play (ALP) is suggested. ALP is the overall amount of time the game is played by each player averaged across all people who have played it. Combining throughput and enjoyability gives the "expected contribution", which is the summary measure for GWAP quality.

Expected contribution indicates the average number of problem instances a single human player can be expected to solve by playing a particular game. In summary: *Throughput* = average number of problem instances solved per human hour; *ALP* = average (across all people who play the game) overall amount of time the game will be played by an individual player; and *Expected contribution* = throughput multiplied by ALP.

4. Games and Motivational Design

It is important to separate between players and customers, consumers or other participants, like employees [Bernhaupt, 2010]. Players are the centre of the game, as opposed to being on the receiving end, like a customer. They also feel a sense of autonomy. Most importantly — players play.

The next sections introduce different views from psychology about motivation and behaviour. Section 4.1 briefly introduces behaviourism and how it relates to gamification, and Section 4.2 looks at positive psychology, which is helpful when designing meaningful gamified systems. Section 4.3 introduces the self-determination theory, which gives more insight into motivation. Section 4.4 discusses the relationship between motivation and rewards in more detail, and finally Section 4.5 looks more specifically at employee motivation.

4.1. Behaviourism

Gamification is about motivating people to do something, whether it's visiting the gamified system more often, or encouraging them to save energy. Therefore, it is important to understand what motivates people.

There are two different ways psychology looks at motivation relevant to gamification. One is behaviourism [Watson, 1913], which focuses on looking at external behaviours. Behaviourism doesn't try to understand what's going on inside a person's head, because it's not scientifically testable. Therefore, it treats the mental state as a black box, and focuses on observing how people behave. That makes it possible to use scientific methods, e.g., testing hypothesis, to understand behaviour. Every action arises from a stimulus, for example, a cat jumping on a lap. The action that arises, is a response, e.g., stroking the cat. One of the most notable research related to stimulus and response, called classical conditioning, was done by Pavlov [1927]. Classical conditioning concluded that stimulus and response are instinctively linked, stimulus creates a response, and a response creates a stimulus. Another notable research, called operand conditioning, links learning into the stimulus-response reaction. The response is conditioned by the stimulus [Skinner, 1938], say, “if I push the lever, I get food”. Most gamified systems today are behavioural systems, because they only use rewards to get people to do things.

Behaviourism is undermined by a few lines of research. Behavioural economics [Camerer and Loewenstein, 2004] studies the effects of social, cognitive and emotional factors on the economic decisions of individuals. According to behavioural economics, people don't always respond to incentives perfectly, but they make “mistakes” constantly. Another theory called loss aversion, which has been first advocated by Kahneman and Tversky [1984], notes that people are more concerned about the 50% chance of losing 100 euros than gaining 100 euros. The power of defaults [Johnson and Goldstein 2003] has also been noticed. People tend to go with defaults, e.g., trusting the search engine and

choose the first result. Confirmation bias [Plous, 1993] (people tend to see what they are looking for, and what they want to see) also tends to happen.

Behaviourism doesn't answer the question: what people think and feel. Cognitivism tries to answer this question. If you think in a purely behaviourist standpoint and treat the player as a black box, you forget the player is a human being, and that the player is the centre of the game. There is potential for abuse and manipulation (consider, for example, the slot machine, people can get addicted to them). Also, there is the issue of the hedonic treadmill [Brickman and Campbell, 1971], which implies that once you start giving rewards, you better keep doing it. Hence, people will only start responding if the reward is there. Keeping this in mind, gamification in a behaviourist approach has to keep people expecting the rewards. A behavioural system will have to rely solely on rewards. Another problem is emphasis on status as people aren't constantly looking for status, e.g., flying 1 000 000 miles for status is probably not important enough for most people.

The takeaways for gamification from behaviourism are observation (observe what people do instead of making theories), feedback loops (stimuli-response creates a motivating loop), and reinforcement (learning occurs by the reinforcement of stimuli) [Werbach, 2012].

4.2. Positive Psychology

Positive psychology is a recent branch in psychology, which has been summed up by Seligman and Csikszentmihalyi. Seligman studied what makes people happy. He came up with five core aspects in being a flourishing individual [2011]. These characteristics are abbreviated as PERMA:

- **P**ositive emotions
- **E**ngagement
- **R**elationships
- **M**eaning
- **A**chievement.

Another key concept of positive psychology is flow introduced by Csikszentmihalyi [1975].

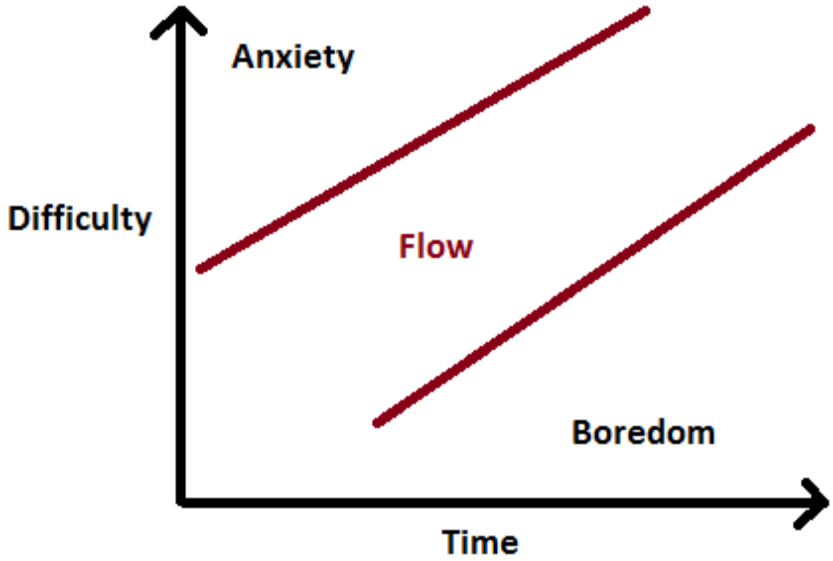


Figure 7: Optimal state for flow to occur [Csikszentmihalyi, 1975].

Flow is the state that can occur when the activity is not too challenging or too easy (see Figure 7). There are a few conditions for flow to occur: clear goals, balance between perceived challenges and perceived skills, and clear, immediate feedback.

Using positive psychology when designing a gamified system will give the system more meaning. It will start to reflect the cognitive side of gamification, meaning it will focus on how people feel about what they do. It aims to make people feel good about themselves.

4.3. Self-determination Theory

Self-determination theory by Deci and Ryan [1985] introduces the motivational spectrum from amotivation (completely indifferent to do something) to broad category of extrinsic motivation to intrinsic motivation, presented in Figure 8. External motivation can be further split in the spectrum: closest to amotivation is external regulation (the only reason you do something, is because someone tells you to), then comes introjection (make the external motivation your own, like getting status for the action, getting people to like you), then identification (e.g., learning math because it helps to cope in modern business world – there's value to me in doing this), and finally integration (there's an alignment with my goals and the thing, e.g., exercise) closest to intrinsic motivation. For gamification, from a cognitivist standpoint, motivating should push the user closer to intrinsic motivation.

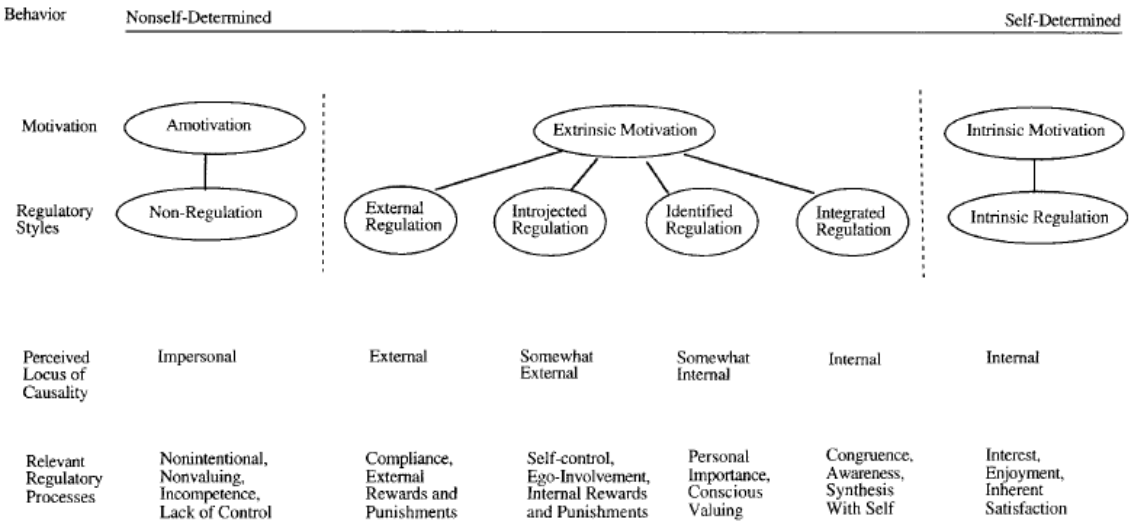


Figure 8: Motivational spectrum by Deci and Ryan [1985].

Intrinsic motivation has three characteristics: competence, autonomy and relatedness (your activity is connected to something beyond yourself). Having these characteristics in the gamified system is more likely to create intrinsic motivation.

4.4. Rewards and Motivation

Rewards and the effects of rewards on motivation have been studied extensively. The next subsections will discuss different kinds of rewards and their value to gamification. Subsection 4.4.1 introduces some reward structures and schedules, Subsection 4.4.2 makes a distinction between extrinsic and intrinsic rewards, and Subsection 4.4.3 notes how rewards can demotivate.

4.4.1. Reward Structures and Schedules

Cognitive evaluation theory [Deci, 1975], which is a sub-theory of self-determination theory, analyses rewards. There are different kinds of rewards that can be offered [Deci et al., 1999]:

- Tangible rewards, like a real mobile telephone, car, food and such.
- Intangible rewards are, for example, verbal rewards or virtual rewards like a badge.
- Expected rewards are rewards that can be seen coming.
- Unexpected rewards are surprises.
- Contingent rewards are further categorized as follows:
  - Task non-contingent means the reward is given no matter what.
  - Engagement-contingent rewards are given just for starting a task.
  - Completion-contingent rewards are given when the task is completed.
  - Performance-contingent rewards are given if the task is done well enough, e.g., getting 85% right in a trivia.

Reward schedules have a significant role in what kind of response the brain produces. There are different types of reward schedules [Ferster and Skinner, 1957]:

- Continuous rewards are automatic, they are received for every incidence of the action.
- Fixed ratio rewards are given every nth time the action is made, e.g., every 5th or 10th login.
- Fixed interval rewards are the same as fixed ratio rewards, but the reward is received every n amount of time, e.g. reward, is given after every 30 minutes.
- Variable rewards are not dependent on time or fixed ratio.

The continuous reward is the least interesting, and it's not really a reward after a few times. The fixed ratio and interval rewards have some psychological value, but get dull after the brain picks up the pattern. The most interesting reward type is the variable rewards, because they can be competitive or non-competitive, and certain or uncertain.

4.4.2. Extrinsic and Intrinsic Rewards

When a person finds doing something rewarding by itself, for example programming, he or she is getting an intrinsic reward: the action is enjoyable, fun and exciting in itself. When a person is doing something, for some other thing, they are getting an extrinsic reward: for example, work for money. Zichermann and Cunningham [2011] have divided extrinsic rewards into four categories called SAPS:

- **S**tatus.
- **A**ccess. Have access to something others don't have.
- **P**ower. Have the ability to do something most others can't do, like moderating a forum.
- **S**tuff, meaning tangible rewards.

The rewards in SAPS are rank ordered from status to stuff, and they are also ranked by how powerful these motivators are. However, it is not necessarily true that status over stuff is the real rank for most people.

4.4.3. How Rewards Can Demotivate

Rewarding someone for doing something they already do – giving extrinsic motivation – will substitute the intrinsic motivation and demotivate [Kohn, 1987; Deci et al., 1999]. This is sometimes called the 'over-justification effect'. There have been several studies on the matter. Many studies have focused especially on the effect of tangible rewards and verbal rewards. For example, Amabile [1985] did experiments, where she asked creative writers at Brandeis and Boston Universities to write poetry. Some students then were given a list of extrinsic (external) reasons for writing, such as impressing teachers and making money, and were asked to think about their own writing with respect to these reasons. Others were given a list of intrinsic reasons: the enjoyment of playing with words,

satisfaction from self-expression, and so forth. A third group was not given any list. All were then asked to do more writing.

Students given the extrinsic reasons not only wrote less creatively than the others, as judged by 12 independent poets, but the quality of their work dropped significantly. Amabile concluded that rewards have a destructive effect primarily with creative tasks, including higher-level problem-solving: "*The more complex the activity, the more it's hurt by extrinsic reward*".

There are also other studies, which show that not only creative tasks are harmed by rewards. In one study, girls in the fifth and sixth grades tutored younger children much less effectively if they were promised free movie tickets for teaching well [Kohn, 1987]. The study showed that tutors working for the reward took longer to communicate ideas, got frustrated more easily, and did a poorer job in the end than those who were not rewarded.

4.5. Employee Motivation

There are several different theories on what employee motivation consists of and how to improve it. These theories have been listed by Accel-Team [2012]. Subsection 4.5.1 introduces Theory X and Theory Y. Subsection 4.5.2 discusses the Two-factor Hygiene and Motivation theory. Subsection 4.5.3 tells about the Hawthorne Experiments and the Hawthorne effect, and finally Subsection 4.5.4 sums up what motivates employees based on all the research.

4.5.1. Theory X and Theory Y

McGregor [1960] developed theories X and Y, and named them after letters of the alphabet in order to avoid prejudicing the discussion in favour of the other [Stewart, 2010]. Both theories have different assumptions about employee motivation. Theory X assumes that people have inherent dislike of work and will avoid it if they can. This would mean that most people should be controlled and threatened before they will work hard enough. Also, the average human prefers to be directed, dislikes responsibility, is ambiguous and desires security above everything else.

Theory Y assumes that the expenditure of physical and mental effort in work is as natural as play or rest:

- Control and punishment are not seen as the only ways to make people work; people will direct themselves if they are committed to the aims of the organization.
- The average person can learn to accept and seek responsibility.
- Imagination, ingenuity and creativity can be used to solve problems by a large number or employees.
- Under the conditions of modern industrial life, the intellectual potentialities of the average human are only partially utilized.

Argyris [1957; 1962] compared the bureaucratic/pyramidal (organizational counterpart to theory X) and humanistic/democratic value systems (organizational counterpart to theory Y). According to Argyris, the bureaucratic system leads to poor, shallow and mistrustful relationships. Because these relationships do not permit free and natural expression of feelings, they are phony or non-authentic and result in decreased interpersonal competence. The democratic system leads to trusting, authentic relationships, which results in increased interpersonal competence, intergroup cooperation, flexibility and the like. These often lead to increased organizational effectiveness.

4.5.2. Two-Factor Hygiene and Motivation Theory

Herzberg et al. [1959] developed the hygiene and motivation theory, which is composed of two components. The first component of the theory, hygiene, consists of

- the organization,
- organization's policies and administration,
- the kind of supervision (leadership and management, including perceptions), which people receive while on the job,
- working conditions (including ergonomics),
- interpersonal relations,
- salary,
- status, and
- job security.

These factors do not lead to higher levels of motivation, but without them there is dissatisfaction. The second component in the theory is focused on what people do on the job and should be included in work in order to develop intrinsic motivation. The motivators are

- achievement,
- recognition,
- growth / advancement, and
- interest in the job.

Both approaches should be done simultaneously. The theory encourages treating employees the best the company can. Employees should be given recognition for their achievements, show interest towards their work, and give them responsibility, so that they can grow and advance in their work.

Two-factor hygiene and motivation theory is based on Maslow's hierarchy of needs [1943]: physiological, safety, love, esteem and self-actualization. The needs are filled so that the physiological needs must be satisfied (food, water, staying alive and healthy) before safety needs are strived for, love needs are 'filled' so that esteem can grow and

finally when all the previous are good, self-actualization needs can be sought after. This means constant self-development.

4.5.3. The Hawthorne Experiments and the Hawthorne Effect

Mayo [1949] did some experiments on human behaviour at the Hawthorne Works of Western Electric company in 1924-1927. The conclusions were as follows:

- Work is a group activity.
- The social world of an adult is primarily patterned about work activity.
- The need for recognition, security and sense of belonging are more important in determining worker's morale and productivity than the physical conditions under which he works.
- A complaint is not necessarily an objective recital of facts; it is commonly a symptom manifesting disturbance of an individual's status position.
- The worker is a person whose attitudes and effectiveness are conditioned by social demands from both inside and outside the work plant.
- Informal groups within the work plant exercise strong social controls over the work habits and attitudes of the individual worker.
- Group collaboration does not occur by accident; it must be planned and developed.

The Hawthorne effect [French, 1950] is the effect of better job performance, when the worker gets to know that the management is concerned for them. It can be seen in a positive and a negative way. For example, the worker may feel important if the organization is willing to spend money on developing his or her skills. It can also be negative in a sense, that worker feels like he or she is being watched all the time, which means better performance, but can also be stressful for the worker.

4.5.4. What Motivates Employees?

To summarize these theories, a list of things that motivate employees is compiled [Werbach, 2012]:

- **Rewards**. Pay, bonuses, stock options, recognition, praise, promotions, and responsibility. All these are extrinsic rewards — they are not about the pleasure of work.
- **Skill development**. Learning new things and problem solving can motivate and make work more fun.
- **Information (or feedback).** Workers want to know how they are doing often, not just in performance reviews every year.
- **Corporate citizenship**. Citizenship behaviours include altruism, conscientiousness, civic virtue, courtesy, and sportsmanship. Work is usually a group activity.

- **Fun**! Work isn't always serious. E.g. having nice co-workers can motivate, or the work itself can be enjoyable.

In order to motivate an employee, the workplace needs to offer sufficient feedback and information to the workers. Rewards are important, and not just the salary, because for most it's obvious, but also bonuses, promotions, praise, and so forth. The rewards can be expected or surprises. Monitoring will motivate as well, though it can be perceived differently by different people. The fact that people do not want to fall too far behind others (communal pressure) is something that drives people. Competition motivates as well, but it can be controversial if it creates tension among workers. They might forget to do their job well and focus on competition.

5. Gamification

Gamification is a relatively new concept, which has gained a lot of attention, from education to social good to business objectives. Deterding et al. [2011] define 'gamification' as ”*the use of game design elements in non-game contexts*”. Adding points, badges and leaderboards, which are very common game elements, is the most common way to gamify a system. This approach is used by many gamified sites, including Foursquare [2013], Fitocracy [2012] and Google News Badges [2012], with varying success. The factors that affect the success of gamification will be discussed in detail in this chapter. Gamification concerns a vast number of existing concepts, like human computer interaction, user experience, serious games and pervasive games to name a few.

Section 5.1 looks at the relationship between gamification and usability, Section 5.2 contemplates why anything has been gamified, and Section 5.3 notes the perceived benefits from gamification. Section 5.4 offers examples of gamified systems. Section 5.5 talks about the criticism and the risks with gamification, and finally Section 5.6 offers advice on how to gamify a system based on everything that has been discussed earlier.

5.1. Gamification and Usability

Can gamification be categorized as a part of usability? This answer can be sought after by defining and breaking down usability into the parts it consists of.

Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use [ISO 9241-11]. In more detail, this definition includes effectiveness as the accuracy and completeness with which users achieve specified goals. Efficiency is the resources expended in relation to the accuracy and completeness with which users achieve goals. Satisfaction refers to the comfort and acceptability of use [Usabilitynet, 2012].

Usability can be further split into understandability, learnability, operability, attractiveness, effectiveness, productivity, and satisfaction. Understandability answers to questions like: do new users understand is the software suitable, and how it can be used for particular tasks? Learnability is concerned with how easy it is for new users to accomplish basic tasks. Operability is linked to keywords like system consistency, self-explanatory messages, undoability and customisability. Attractiveness consists of screen layout and colour. Effectiveness can be measured by how quickly the users have learned the design, and how quickly the users perform tasks. Productivity answers how productive the user is while using the system. Satisfaction evaluates whether the user is satisfied with the system: what proportion of potential users choose to use the system?

As I see it, usability is focused on the interface being as easy to use, understandable and efficient among the things listed. Gamification is concerned about motivating people to use the system for specific purposes. In the case of this thesis, and probably otherwise too, both are used to accomplish the same goals: increasing user's effectiveness,

productivity and user satisfaction. Although the approach is different for usability and gamification, they are intertwined, as gamification directly affects the usability of the system. Gamification can be used to improve usability by using game mechanics to help people learn and understand the system, and use it as efficiently as possible. This has actually been done by Microsoft in their gamified application called Ribbon Hero [2010], which helps the user to learn how to use MS Office. Also, usability can improve the effects of gamification by making the gamified system usable, and hence improve the user experience.

5.2. Why Gamify?

Zichermann [2010] gave three ways of behaviour as a result of some action. Behaviour can be against interest, like a person with an addiction behaves. Way of behaviour can also be predictable, e.g. if you run out of food you need to get some more food to eat. It can also be unforced (as it usually is), meaning it is voluntary behaviour. A person with an addiction may behave against interest and unforced, but not necessarily predictably. A person buying food acts in a predictable way and unforced, but it's not against interest. Another person may force another one to do something against his or her interest in a predictable way, but it's not unforced. While a little dark example, Zichermann [2009] states that games are probably the only things that can make people behave against their interest, in a predictable way and unforced (see Figure 9).

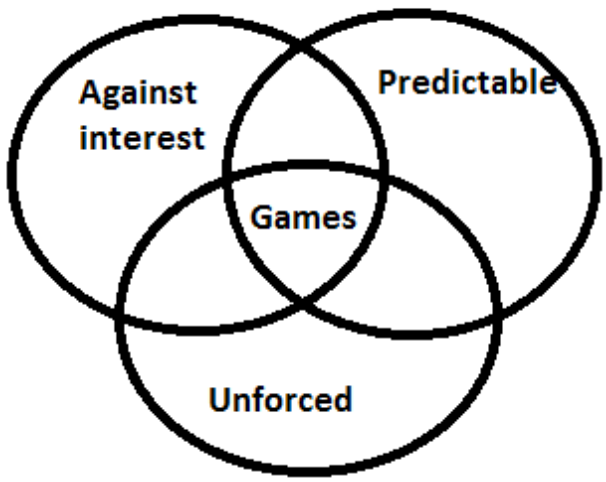


Figure 9: Persuasive games by Zichermann [2010].

Not only can games be powerful, especially video games are very popular among kids, teenagers and young adults. At least in 2008, as much as 97% of teens in ages 12-17 played games [PewResearch, 2012]. Not just young people play: the average game player is 30 years old. There is not much gender bias, as 47% of game players are female. The statistics also show that 62% play games with others, either online or in-person. In

the US alone, consumers spent 24 750 000 000 dollars on games industry [ESA, 2012]. These statistics regard only the US, but they give some sort of guidelines as to video gaming popularity in western countries.

When it comes to enterprise gamification, Williams and Smith [2009] see gamification as a way to bridge the gap between organizations and the young 'gamer-generation', who bring their own priorities, communication patterns and perspectives to the work place. The influence of games on their expectations of work and life cannot be underestimated. Williams and Smith [2009] argue that leveraging games to engage this generation seems an obvious path to increasing engagement of young employees. However, they note that this approach is not only limited to the young, but all ages, who find games engaging and fun.

Games are popular and potentially persuasive. For marketing people it is a whole new way of reaching potential customers and induce brand loyalty. For enterprises it can be a way to make employees more motivated. For schools game design can be used to provide a more enjoyable learning environment and better learning outcomes.

5.3. Gamification Forecast

The reason why gamification has been a buzz word in recent years, is because even the simple game elements, like badges, have been successful at least a short while, for example, with Foursquare [2013]. Gaming Business Review website has made a report about gamification market and forecasts in 2012. The report uses M2 Research services [2012] for gamification forecasts.

The report describes common metrics to measure gamification success, shown in Figure 10. These metrics can be split into four categories: engagement, loyalty, virality and monetization. Engagement is measured, for example, with the number of page views, unique visits and the time spent on site. Loyalty can be measured by the number of repeat visits and friend referrals. Virality is measured by the number of shares and social communications happening around/in the site. Monetization is summed by conversion rates, purchase of virtual goods and registration. These metrics mainly concern sites, which try to appeal to users. They are not very suitable for enterprise gamification, which usually aims to motivate and improve worker performance.

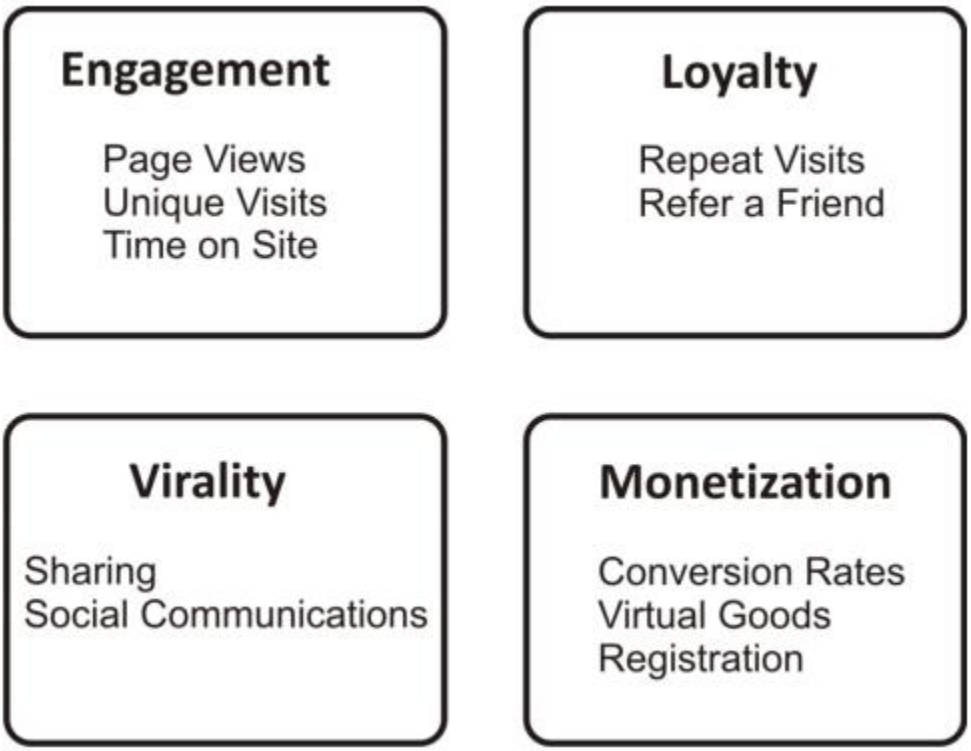


Figure 10: Common metrics to measure gamification success [Gaming Business Review, 2012].

M2 Research [2012] has made a gamification market forecast, which is shown in Figure 11. The revenue estimates are comprised of platform vendor revenue, agency and production revenue and internal development. "*In 2012, businesses will increasingly expect ROI accountability and measurable results to replace much of the early excitement for gamification that focused on "gamified" applications that frequently have been treated as standalone opportunities*" [Gaming Business Review, 2012] on consumer gamification.

(in millions)	2011	2012	2013	2014	2015	2016
Total	$100	$242	$522	$980	$1,707	$2,830

Figure 11: Gamification market forecast [M2 Research, 2012].

The Gaming Business Review report also looks at enterprise gamification, because it's going to be a growing market competing with consumer gamification. According to the report, enterprises have internal and external desires for enterprise gamification. Internal desires focus on improving worker performance and driving employees to work as teams rather than individuals. Gamification can be used to drive primary team goals, e.g., customer service and sales, through valued incentives. Team work can be emphasized by connecting distributed work environments through social components. Competitive team approach, and favouring teams and interaction over individualism could be intensified. Gamification can be used to train employees and leveraging, recognizing and rewarding employee effort, creativity, contribution and success. Finally, gamification can be used to collect measurable results. While emphasis on teams and training can be achieved without games, using game design can give valuable insight how to handle the process.

External desires are focused on issues that have value to the company indirectly, like encouraging interaction between employees and gaining good direct and indirect reputation. Gamification can be used to encourage the use of personal social networks, engaging partners and alliances, and driving community engagement. It can indirectly

help with market flexibility as well. Gamification can be helpful in keeping employees around, and attracting new hires. It offers many things the ‘gamer generation’ values, such as direct and immediate feedback and transparency in decision making.

According to Gaming Business Review's report [2012], the desire/motivation to succeed in gamification is founded in competition, status, scores, leaderboards, and metrics leading to key performance indicator (KPI). These are all aspects that drive worker performance, in the case where employees find competition appealing. The motivation to succeed in gamification is also founded in monetary rewards, non-monetary rewards, achievements, and progress. These again are aspects that have to do with feedback and rewards. Gamification might increase the value of non-monetary rewards, but this should not undermine the value of monetary rewards.

5.4. Examples of Gamified Systems

This section introduces a few examples of gamified applications and contemplates why they have succeeded or failed, and why game elements have been used in them. Subsection 5.4.1 introduces Foursquare [2013], which is one of the first gamified applications. Subsection 5.4.2 tells about the Language Quality Game [Williams and Smith, 2009] in more detail. Subsection 4.5.3 discusses Google News Badges [2012] as a warning example. Subsection 5.4.4 introduces Fitocracy [2012], an example of social good gamification. Subsection 5.4.5 showcases Stackoverflow [2012], which is one of the most successful examples, and Subsection 5.4.6 presents Digitalkoot [2012], which is closely related to the case study. Finally, Subsection 5.4.7 introduces Google Image Labeler and ESP games [von Ahn and Dabbish, 2004; 2008], which are examples of output-agreement games.

5.4.1. Foursquare

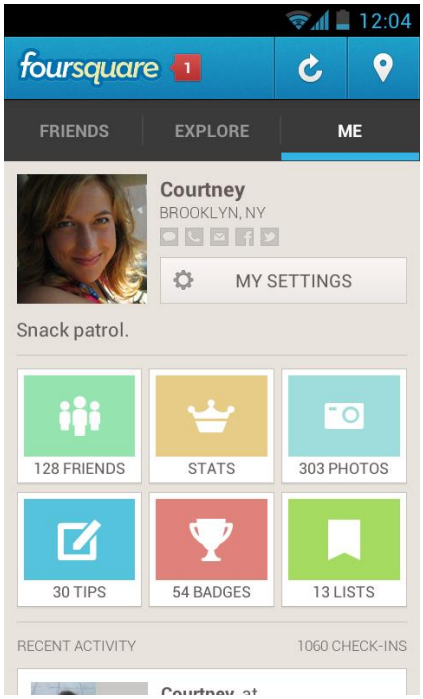


Figure 12: An Example profile in Foursquare [Foursquare, 2013].

Foursquare is one of the first services to apply gamification. Before it, there was a mobile application called Dodgeball, which was a location-based service that allowed people to notify which bar they were in, and to see where their friends were [Foursquare, 2013]. Dodgeball was bought by Google in 2005. The founders of Dodgeball left Google in 2007 and started a company called Foursquare. Foursquare is the same as Dodgeball, but it includes more venues.

With Dodgeball, there was a problem with not enough people checking in, which discouraged them to check in. In order to solve the problem, Foursquare used badges to make checking in more interesting and fun. The user would get a badge, if he or she checked in at a specific location, or checked in multiple times from the same one. Some badges were more difficult to get than others. Figure 12 shows an example profile, which shows the gamified side of the application.

Foursquare became a successful application. It has a community of over 25 million people, with over 2 500 000 000 check-ins [Foursquare, 2013]. There has been hype around the company, but it doesn't tell how many people actively use the service. Foursquare's gamified aspects are much less visible today than before, possibly because the service has achieved its "critical mass" of users. This raises the question whether gamification has some sort of life span for when it is useful.

5.4.2. Language Quality Game

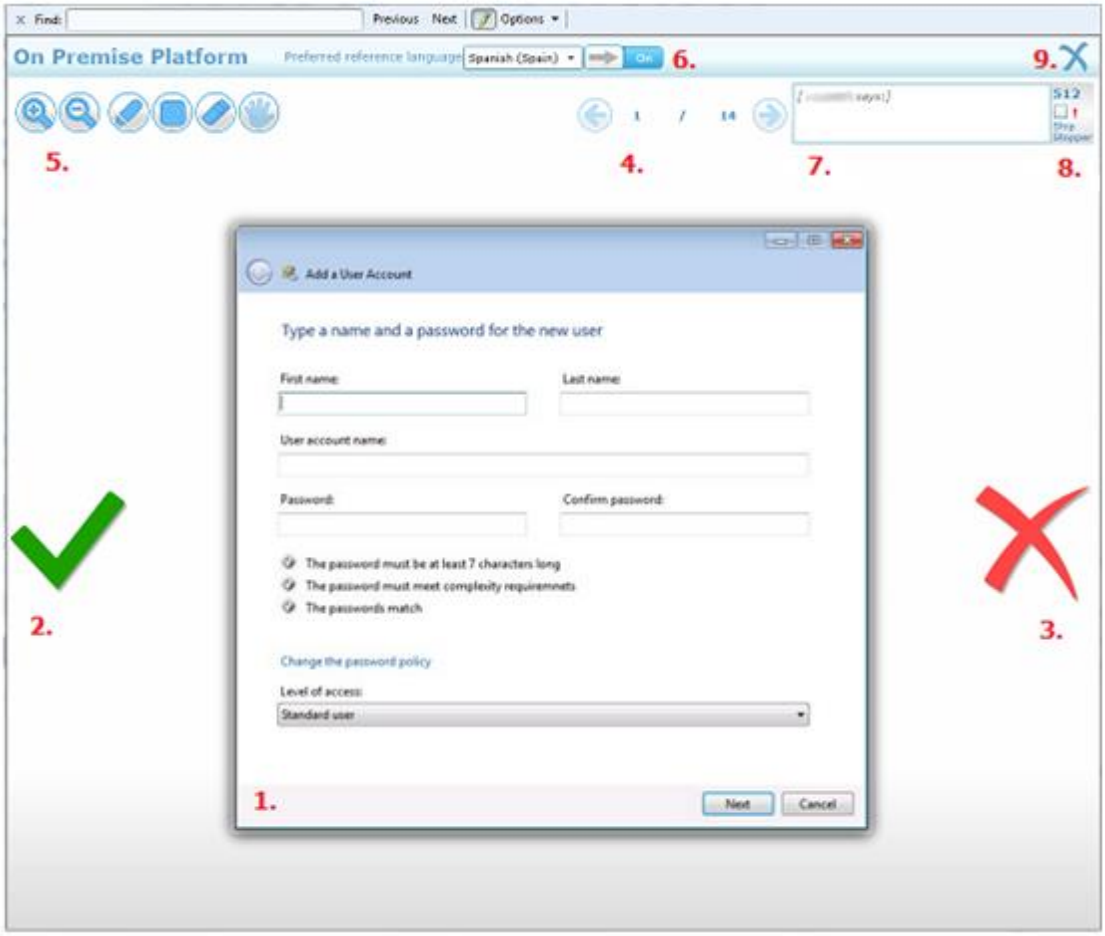


Figure 13: Screenshot of language quality game [Microsoft, 2012].

Language quality game is a gamified web-based service that allows to view various Microsoft software in different languages. The game was made for Microsoft employees, so they could review the translations in their native language [Williams and Smith, 2009; Smith, 2011; Microsoft, 2012]. The service encouraged thousands of its employees to look for errors in the translations in their native language. Workers did it voluntarily with good results [Smith, 2011]. In 2009 after a month of game play, there were over 4 600 players, over 530 000 screens reviewed (points received) and there were over 6 700 defect reports [Williams and Smith, 2009]. This is an example of corporate citizenship and workplace gamification. It worked well, because it suited in the organization: it was a core skill for all to speak their native language, and it appealed to corporate citizenship.

The game elements used in the language quality game were game levels, earning different colour mark-up pens, graphical image movement and a leaderboard [Williams and Smith, 2009]. Each game level had 25 images to review, as shown in Figure 13, after which players got to a higher level. Different colour mark-up pens were earned by reviewing enough images. Graphical image movement means that the player could move a reviewed image to “looks good” or “something wrong” pile. It was meant to add visual

interest and gaming feel to the experience. Finally, the leaderboard was meant to stir some competition.

5.4.3. Google News Badges

Figure 14: Google news badges [Webification, 2011].

Google News Badges was a gamified system, where the user received badges for reading news articles [Webification, 2011; Google News Badges, 2012]. For example, if the user read 50 articles based on basketball, he or she would have received a badge about that. Some of the badges are shown in Figure 14. The badges were more like notifications than rewards, because the user would have read the article anyway. This is not one of the best examples of gamification, as it doesn't encourage people to do anything they wouldn't already do. It also encouraged people to read a lot of articles about the same topic, when news are about finding out a little bit about everything. Recent article on Google News Badges [2012] says that Google has removed this feature. Through this example, it is important to keep in mind what the gamification is for, and what business value it's trying to achieve.

5.4.4. Fitocracy

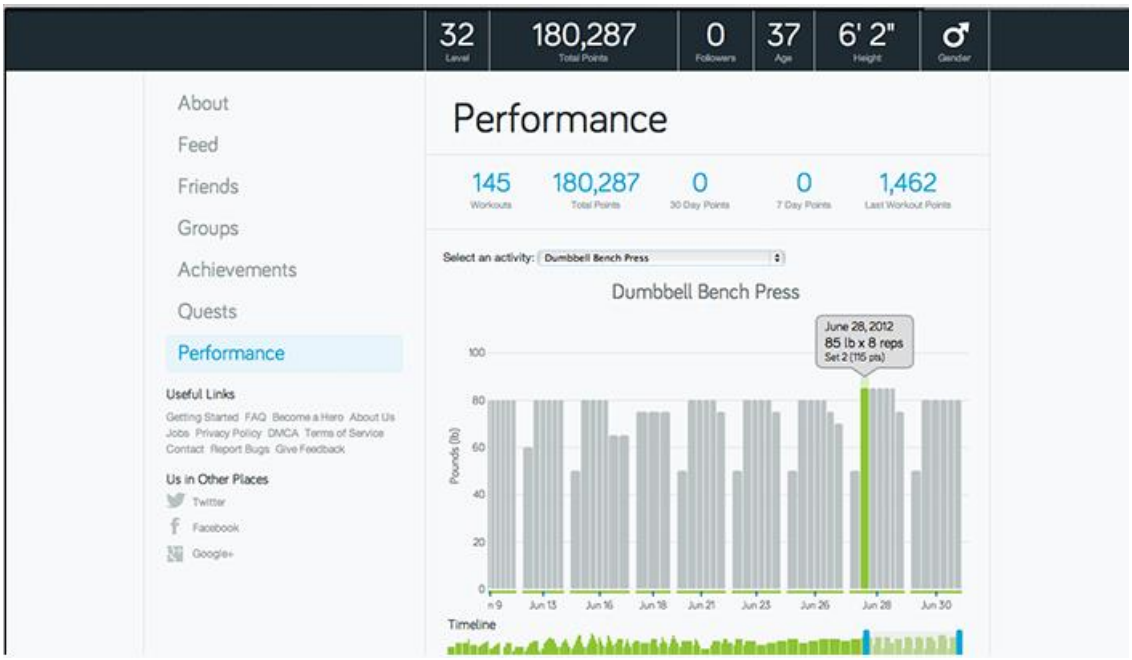


Figure 15: Fitocracy performance page in profile [Fitocracy, 2012].

Fitocracy [2012] is a gamified service that helps people to reach their fitness goals. The site is built to make exercise intrinsically motivating, as it tries to make people feel good about themselves when they exercise. This is shown in small ways in the service; for example "ok"button for confirming dialogs is rephrased as "I'm awesome", when the user logs in a new exercise. Fitocracy is an example of social good gamification, as it encourages people to exercise and live healthy. The site entails all the usual points, badges and leaderboards, as seen in Figure 15, but it applies them in a meaningful way. The single achievement is backed by a social network that shows the user is not alone in his or her journey (to reach his or her fitness goals). This ties to the concept of relatedness, which is a part of the self-determination theory.

5.4.5. Stackoverflow

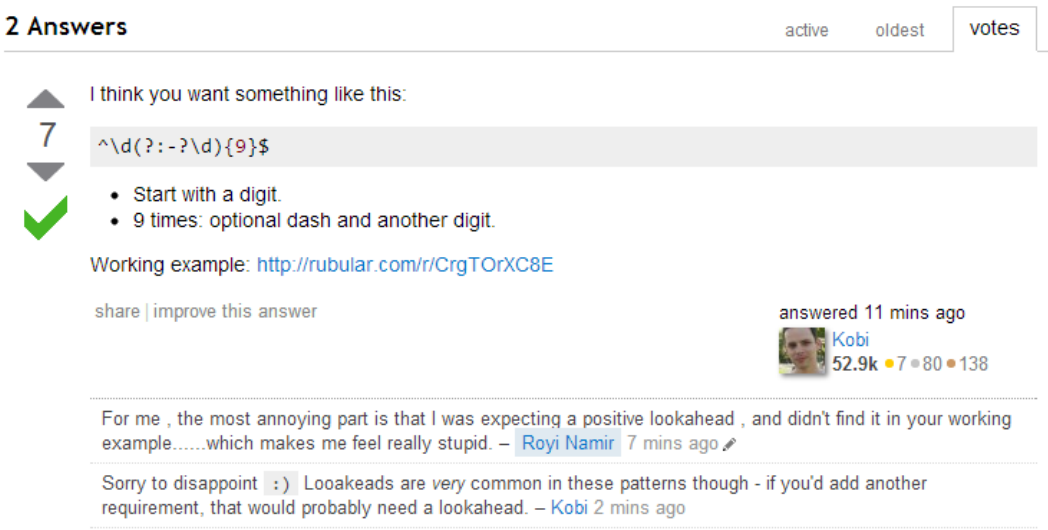


Figure 16: Answer to a programming question [Stackoverflow, 2013].

Stackoverflow [2013] is a question and answer site for programmers. It is one of the best examples of using gamification in a thoughtful and meaningful way. The site has become pretty successful, it has over 2 million users, with 5000 new questions per day and over 10 000 answers per day on average [Stackoverflow, 2013]. Stackoverflow works much like Wikipedia, once the system learns to trust the player, meaning the player has enough reputation given by other players for answering and asking questions. The site is collaboratively built and improved by its users.

Stackoverflow has been successful, because it knows its users. The site creators know that programmers find programming fun, usually. Programming is intrinsically motivating in itself for some programmers. Helping other programmers is the way to 'win' in the game. People get points from other users based on replies and questions, and the points are viewed as reputation. The reputation gives power to moderate the site, in increasing volumes, such as improving other user's answers. Badges are given for things that are in the interest of the site and the group, to encourage collaboration. Figure 16 shows an answer to a programming question. The green check mark indicates that the reply has been approved by the person who asked the question, and the number above the check mark shows how many times the answer has been up voted (or down voted if the number is negative). The bottom right of the post shows the user, who answered, and how much reputation he or she has.

5.4.6. Digitalkoot

Figure 17: Digitalkoot: Myyräsilta (mole bridge) on the left and Myyräjahti (mole hunt) on the right.

Digitalkoot [2012] is a game that was made in partnership with a company called Microtask and the Finnish National Library, with the goal to digitize Finnish national archives. People were needed to review and proofread optical recognition character (ORC) results. There were two versions of the game. In the first version of the game (see Figure 17 left side) players helped moles cross bridges. The second version (see Figure 17 right side) presented tasks to proofread by incorporating them into a mole hunt game. The project got nearly 110 000 people to review over 8 million specific examples in the digitization process [Digitalkoot, 2012]. Although the project was a success, there were people who only wanted to help the Finnish National Library, and found the game distracting.

5.4.7. Google Image Labeler and ESP game

Figure 18: Screenshot of Google Image Labeler [Seroundtable, 2012] on the left and ESP game [von Ahn and Dabbish, 2004] on the right.

Google Image Labeler game used crowdsourcing to label images by turning the activity into a game. This is an example of GWAPs, more specifically of output agreement games. Google Image Labeler is based on the ESP game by von Ahn and Dabbish [2004]. Figure 18 shows a screenshot of Google Image Labeler on the left, and the ESP game on the right.

The game is played by two partners, with a large number of partners online. The partners are assigned randomly among all the people playing the game. The players are not told who their partners are, and they are not allowed to communicate. The only thing in common is the image they both can see. The player needs to guess what his or her partner is typing for each image. This type of approach improves the quality of the labels. Once both have typed the same word, the next image comes. The partners try to agree on as many images as they can in a fixed amount of time, and they get a score based on the amount they agreed on. To succeed in the game, the players need to think like each other, and because they don't know each other, they need to rely on the image. Von Ahn and Dabbish [2004] noticed that the string, which the two players agree on, is typically a good label for the image. The labels are attached in images based on a label threshold; a certain amount of pairs must produce the same output. The higher the threshold, the stricter the labelling.

For the ESP game, almost 1.3 million labels were collected with 13 630 players, some of whom spent over 50 hours playing the game. In 2008, when Google had obtained the game, there had been over 200 000 players, who had contributed more than 50 million labels [von Ahn and Dabbish, 2008].

5.5. Criticism, Risks and Regulation

Gamification is not without criticism and issues to look out for. Many game designers have openly criticized gamification, and its probable unethical usage. They are concerned about the term 'gamification', as it implies that turning something more game-like is easy [Bogost, 2011]. There are also legal and regulatory issues, as well as players' habit of 'gaming the game'. Subsection 5.5.1 and Subsection 5.5.2 introduce the terms pointsification and exploitationware. Subsection 5.5.3 discusses the possible dangers and misunderstandings that can arise with gamification, and Subsection 5.5.4 mentions the legal and regulatory issues to look out for with gamification.

5.5.1. Pointsification

Most gamified applications today focus on points, badges and leaderboards. They treat these game mechanics as the key elements of games, when in reality they are the least essential parts of games. This kind of gamification is based on behaviourism. Robertson [2010] came up with the term 'pointsification' to describe these kinds of gamified systems. Gamification can be an inadvertent con – accidentally misleading people to think there is a simple way to imbue their thing (e.g., job, or exercise) with the power of a great game.

Crowding out effect of gamification could happen especially if it reduces to pointsification. In the words of Sierra [2011], "*gamification is the high fructose corn syrup of engagement*", meaning gamification will reduce games into something very simplistic and shrill. Like corn syrup, first it's great and sweet, then we realize it's dangerous to us.

5.5.2. Exploitationware

Game designer and scholar Bogost [2011] has suggested renaming gamification as 'exploitationware'. In pointsification, the criticism is about gamification being shallow. For exploitationware, gamification can be too powerful and it can make people do things that aren't in their interests. Gamification replaces real incentives with fictional ones. Real incentives come at a cost but provide value for both parties based on a relationship of trust. By contrast, pretend incentives reduce or eliminate costs, but in so doing they strip away both value and trust. This is a genuine concern if gamification is used unethically. For example, employers might find it an easy way to replace an actual pay raise with a badge. Basically, gamification is an intentional con.

Rey [2012] agrees with Bogost and takes his thoughts further. Gamification is about duping people to do free labour. Gamification is a process of producing playbor (combination of work and play). Rey continues, that gamification will mask work as play, and infiltrate leisure time. This way leisure time wouldn't be leisure or freedom from the system any more, but something new to be controlled and administered. Viewing gamification from this perspective, Rey proposes the term 'workification' to describe introduction of work elements into play.

The implications for pointsification and exploitationware is that names are powerful. Gamification can be handled poorly or used unethically. However, it is good to keep in mind that gamification isn't about turning something into a game. There is more to gamification than games, and there is more to games than gamification.

5.5.3. Gaming the Game and Unintended Consequences

Cheating is a common issue in games, if players find a way to cheat, they will. Cheating is often possible due to bugs in the system, or by faulty design that doesn't take into account all loopholes. An example would be that, during a fight a player finds a spot in the game world that the enemy can't get to, or can't harm the player in. The player can use the opportunity to fight the enemy from this spot. Of course it is always possible, that the spot was built in by the game designers. Social pressure may prevent cheating, especially in multiplayer games.

Gamification may have unintended consequences due to cheating. People may respond to the system in unanticipated ways, or even too much in the way that is anticipated. For example, the toll for crossing the Bay Bridge was gamified in the way that, if the person would cross the bridge during rush hour, the toll would increase. The toll would change back to the original price at 7 pm. If people were getting to the bridge near 7 pm, they would drive dangerously to the side of the road to wait for the toll to change [Werbach, 2012]. Basically, gamification can have even deadly consequences. Another example is from day care pickup, where employees were frustrated, because some parents were late to pick up their kids. They decided, that it would cost, say, ten dollars, if the parent was late five minutes or more to pick up their child. What happened is that parents would come even later, because they were happy to pay the ten dollars to get longer day care. The reason why parents used to try to be on time before was social pressure, as they didn't want to inconvenience the day care employees and look like bad parents. Adding the fee erased this social pressure.

It is important to understand that the people using the gamified system are in the centre of the 'game'. They are thinking, feeling human beings with their own ideas and needs. The rules imposed in gamified systems may have many unintended consequences, for example, adding a score system will get people to try to get points. It is good to think about whether it supports the goals of the gamified system.

5.5.4. Legal and Regulatory Issues

There are some legal issues concerning gamification to look out for [Werbach, 2012]. Privacy is an issue, as the gamified system may have a lot of information about its players, since it’s likely to collect more statistics from its users. Employment and labour law need to be followed, in order to avoid exploitation. Deceptive marketing is something to look out for as well, perhaps gamification will give rise to new laws, because it enables novel ways of marketing. There are also intellectual property laws, which is a developing issue.

There are issues with virtual property rights, licence versus ownership etc. What if a user buys a virtual product, e.g., a precious artefact in a game world, and the game designer decides to take it away? At the moment there aren't any clear answers to such questions.

There are also some regulatory issues [Werbach, 2012]. Paid endorsements have regulations to look out for. If there is virtual currency, which can be traded to real money, there are banking regulations to follow. These include record-keeping, reserve requirements, currency manipulation, anti-fraud, money laundering, consumer protection, taxation and accounting. Sweepstakes and gambling have regulations as well. It is advisable to check out the possible regulations concerning the gamified system in the country the system is being used in, or international regulations.

5.6. Gamifying a System

Before even thinking about how to gamify a system, it should be checked whether gamification suits the business problem. Subsection 5.6.1 looks as this question. Subsections 5.6.2, 5.6.3, and 5.6.4 offer guidelines for gamification, with the last one focusing on GWAPs.

5.6.1. Gamification Suitability

Gamification doesn't suit every situation. It is actually only suitable, when the problem is motivation, not money or lack of time for instance. In these types of situations gamification won't help. Gamification is about motivating, so the problem needs to lie in lack of motivation. This issue can be seen, for example, in enterprise gamification. If a person finds his or her job intrinsically motivating as it is, gamification will most likely only do harm.

According to Werbach [2012], there are four questions to determine whether gamification is right for the business problem:

1. Motivation. To emotional connections, unique skills, creativity, or teamwork. Or, to make boring tasks interesting. Where would you derive value from encouraging behaviour?
2. Meaningful choices. Are your target activities sufficiently interesting?
3. Structure. Can the desired behaviours be modeled through algorithms?
4. Potential conflicts. Can the game avoid tension with other motivational structures, for example, competition in a workplace? People may focus on competing against each other and forget to do their job well.

When it comes to enterprise gamification, is it possible to combine work activity with play and have it remain voluntary? If it’s not voluntary, it becomes playbor [Rey, 2012]. For example, Disneyland had a gamified system for their laundry workers awhile back. There were big flat-screen monitors hanging on the walls of the workplace, which showed the worker’s work speed compared to one another [Lopez, 2011]. Workers were listed by name, so the workers could see who was the quickest at their job. This system caused

stress to the workers, who called it the ’electronic whip’. It made them feel like they were controlled even more and it led to competition among workers. As some were more competitive than others, it made the workers feel like reasonable pace isn’t enough to keep the employer happy. The workers would, for example, skip bathroom breaks when trying to keep up. It is not only important to think whether gamification suits the business problem, but what kind of gamification fits it.

5.6.2. General Guidelines

Some general tips are provided for design thinking by Werbach and Hunter [2012]. The first thing to remember is that gamification always has a goal. Once it has been stated that gamification is suitable for the business problem, it is important to recognize the goal that needs to be achieved. Another thing to remember is that gamification appeals to human beings, who think and decide on their own. Therefore, the design needs to be human-centered, as people who come across it always see it as an experience.

Analytical and creative thinking should be balanced. On the other hand, the application is not a game, and is not being turned into a game. It should create motivation or incentives to do something that gets the business towards its goal. On the other hand it should have resemblance of the way games work, which helps it to create motivation or incentives. Design thinking is iterative, it involves trying, failing, and trying again. Usually gamified systems involve prototyping and playtesting just like actual games.

There are a few tools that are specific to enterprise gamification in general [Gaming Business Review, 2012]. First, there is transparency of the application and the definition of succeeding. Transparency is important to maintain the trust between workers and employers. Infinite gameplay with multi-level design is one tool, because work is “infinite” in the sense businesses try to continue as long as they can usually. Of course, there are projects, which have an end, but then the gamification only applies to that one project. If employees have levels to achieve, and there is a top level, they run out of game play when they achieve the highest levels. Having access to related resources and feedback is a tool that is connected to transparency. It helps the employees to develop their skills and handle their work better. The last two tools offered by Gaming Business review [2012] have to do with communication between supervisors and colleagues.

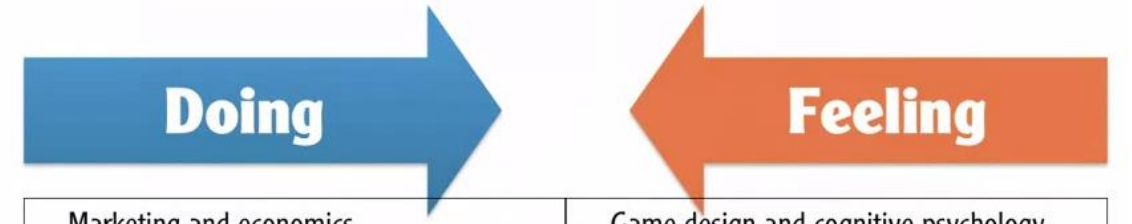
5.6.3. The Six D’s

Werbach and Hunter [2012] offer a design framework for gamifying systems called the Six D's:

1. **D**efine your business objectives. Is the system a success or a failure?
    1. List and rank possible objectives.
    2. Eliminate means to ends. Cut out the objectives that aren't your actual goals.
    3. Justify your goals. Why are they your business objectives?

2. **D**elieniate target behaviours. What do you want people to do?
    1. What are the success metrics (win states)? What will let you decide you have achieved the goals?
    2. Analytics. What are the ways to measure the path towards the win states? For example, DAU (=Daily Average User) / MAU (=Monthly Avg. User) (if DAU/MAU is 100%, then every user comes back every day of the month, which implies that the site is engaging), virality (referrals to friends to go to the site), or volume of activity (track how many points, levels etc. are gained and what are the users doing, like earning points more than anything else).
3. **D**escribe your players. Who are your players? What motivates them? Which player types do they represent?
4. **D**evice activity loops.
5. **D**on't forget the fun!
6. **D**eploy the appropriate tools.

The two approaches of gamification are depicted in Figure 19.



Marketing and economics	Game design and cognitive psychology
Incentives	Experiences
Satisfying needs	Fun
Game elements (inductive)	Game thinking (deductive)
Status	Meaning
PBLs	Puzzles
Rewards	Progression
Making users do things	Making players awesome

Figure 19: Two approaches to gamification [Werbach, 2012].

The other one is about doing, the behaviourist approach. The other is about feeling, not about what you do, but how you feel about it. The behaviouristic approach is defined by marketing and economics. It offers incentives to do things and relies on game elements, such as PBL's, to reach its goals. The behaviouristic approach relies much on rewards. The feeling approach is defined by game design and cognitive psychology. It relies on experiences instead of incentives and employs game design (thinking) instead of trusting solely on game elements. It's more about making user's feel good about themselves and trying to achieve motivation that is closer to intrinsic motivation.

5.6.4. Design guidelines for GWAPs

There are also design guidelines for GWAPs specifically, offered by von Ahn and Dabbish [2008]. GWAPs were introduced earlier with three generic templates for output-agreement games, inversion-problem games and input-agreement games. Along with using these templates, it is important to understand some game-design principles. Many studies cite challenge as a key aspect of any successful game [Malone, 1980; Malone 1982; Pagulayan et al., 2003; Sweetser and Wyeth, 2005]. Challenge translates to game features [Malone 1980; 1982] like timed response, score keeping, player skill level, high score lists (leaderboards), and randomness. These features are introduced next, except for parts that have already been covered.

Setting time limits for game sessions introduces challenge in the form of timed response. It is effective, because it establishes an explicit goal that is not trivial for players to achieve if the game is calibrated correctly [Malone 1980 and 1982]. Goals that are well-specified and challenging lead to higher levels of effort and task performance than goals that are vague and too easy [Locke and Latham, 1990].

A player may be assigned a skill level based on the number of points he or she has achieved. Everyone starts with the lowest skill level and build up from there. In the ESP game, many players seemed to keep playing just to reach a new level [von Ahn and Dabbish, 2008].

Randomness is not only for preventing cheating, but the input should be random as well. When the tasks are random, their difficulty varies, which keeps the game interesting for both novice and experienced players. It also means that every game session involves uncertainty about whether all inputs will be completed within time limit, adding to the challenge experienced by players. Also, it makes every game different.

The different templates for output-agreement games do not prevent cheating by themselves. Von Ahn and Dabbish [2008] provide some general guidelines besides random pairing to increase output accuracy. One way is player testing. In it, the game gives the player inputs, for which all possible outputs are already known, then checks if player provides the correct result. If the player repeatedly gives the wrong result, he or she can be considered suspicious. Repetition is another method, the output isn't considered correct until a certain amount of players have agreed on it. Taboo outputs are useful for inputs that can be described with many outputs, like labelling images. Taboo words are words that are already considered correct.

Among more general guidelines by Von Ahn and Dabbish [2008] is pre-recorded games, which is used if not all players can be paired. In a pre-recorded game, the player plays with a pre-recorded set of actions from previous games. There can also be more than two players. For example, the ESP game can be modified so that a group of five is formed, and the first two that get the same output win the round. Note that the two-player versions are in nature collaborative, multi-player versions are competitive.

6. Case Study

This chapter introduces the case study. Section 6.1 introduces the tasks and workflow that is being gamified. It also introduces the current user interface, and the means it uses to improve worker accuracy and efficiency. Section 6.2 reviews the results of a questionnaire, which was meant to find out the attitudes towards gamification, and workers' gaming habits. Section 6.3 introduces the case study's design and implementation.

6.1. Regular Workflow

The system that is being gamified is a part of a larger system that handles microtasks. It is called DWA (Distributed Worker Application), and it is only meant to show the tasks to workers, take the responses and pass them on.

Microtasks in this case are form field contents. Paper forms are scanned, and their fields are identified and separated. The fields are then grouped into similar task families, for example, phone numbers and names. Finally the contents of the fields are solved by humans. The form contents are usually handwritten, which is why humans are needed. Microtasks are essentially HIT's.

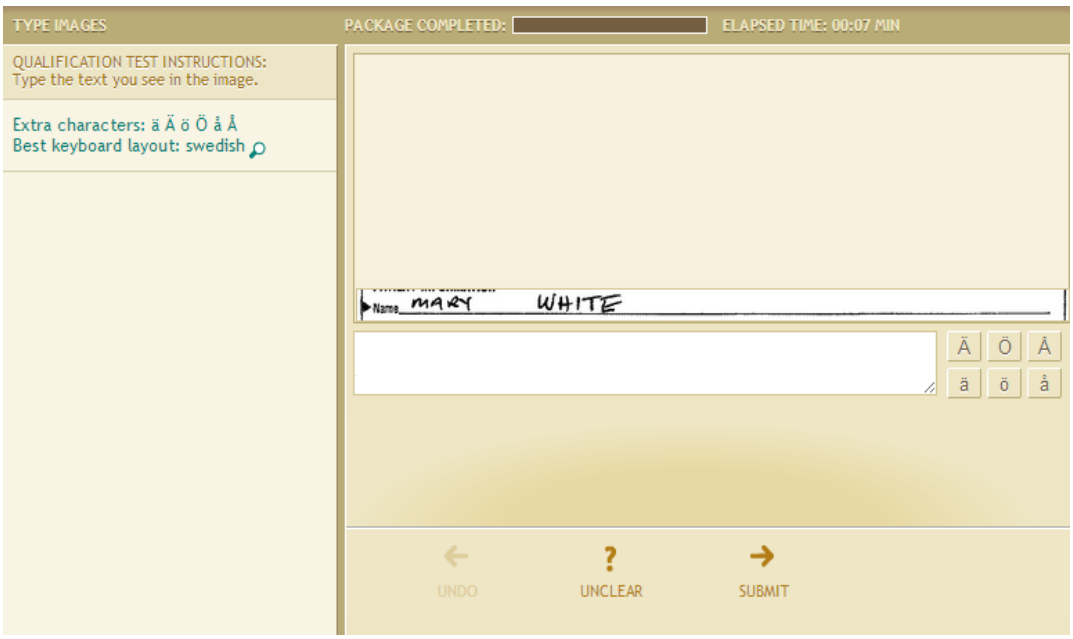


Figure 20: Example of a microtask.

Figure 20 shows an example of a microtask and the user interface used to work on microtasks. On the left side there are instructions on how to solve the tasks, if there is anything specific about the tasks at hand. If there are any special characters, e.g., Scandinavian ö, they are listed and provided as buttons next to the text area. The preferred keyboard layout is also showcased.

Figure 21: Dictionary help.

The workspace offers dictionary help (see Figure 21), if the task family is known to hold certain words or numbers. For example, if it is known that the form fields should have countries in them, a dictionary of all possible countries can be provided with the tasks. This is helpful especially with content that appears often. It might also help in recognizing unclear handwriting. The dictionary help is meant to improve efficiency and accuracy with the user interface.

The user interface is designed so that it is as clear as possible. There is nothing that drives attention away from work. The following are meant to improve worker efficiency and accuracy with the user interface and the system in general:

- The dictionary support.
- Keyboard shortcuts to all buttons.
- Displaying the elapsed time (shown in top of Figure 20).
- Displaying work progress (shown in top of Figure 20).
- Specific instructions concerning the tasks.
- Tutorial videos.
- Qualification tests.
- Randomly distributed verification tasks in middle of task packages.
- Keeping the user interface lightweight, so it doesn't delay work.
- Same tasks are usually sent to one or two workers.

The elapsed time and work progress can also be considered as game-like elements, because they don't actually help the worker to do anything. They only provide feedback, which might have psychological effect. A worker might be delighted to see an almost full progress bar, for example.

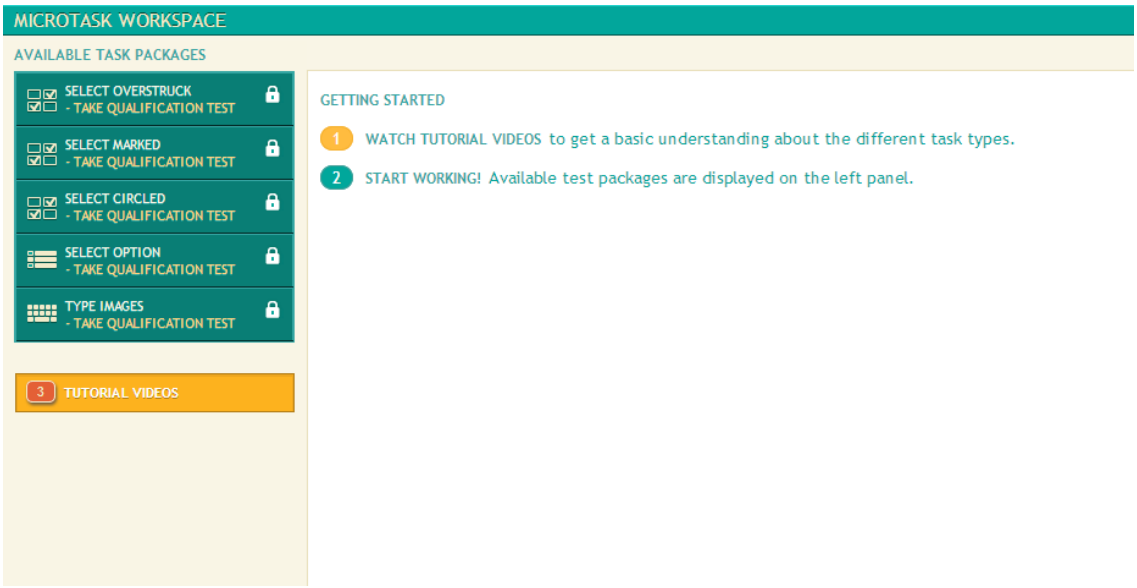


Figure 22: Regular worker dashboard.

Figure 22 shows a worker dashboard that lists the available tasks grouped in task packages by task family. One task family holds tasks of the same kind, for example, phone numbers. Every task family requires that the worker first passes the related qualification test to make sure the worker is qualified to do the real tasks. Verification tasks are randomly placed inside task packages to make sure the worker is really solving the tasks and not typing incoherent text. The dashboard also shows tutorial videos that help the worker to get a basic understanding of the tasks.

6.2. Microtask Workers

Microtask has outsourced the process of working on microtasks. Clients send scanned forms to Microtask's system, which splits the form into separate form fields. These form fields are sent to a company with workers, who record what's in the form fields. In order to get to know the players of the gamified system, a questionnaire was sent to them. The questionnare inquired basic information (age, sex, country), gaming habits (what kind of games they like to play) and attitudes towards work as it currently is, and how they would feel about a gamified system. The questionnaire can be found in the attachments.

The questionnaire was sent to ten workers. Ten replies were received, with promising results. Five (50%) of workers were between 18-25 years old, three were 26-35 and two were 36-45. There were five male and five female, half and half, so there was no gender bias. Seven respondents were from Pakistan, three from the Philippines.

The second part of the survey queried gaming habits. Sports, card games, board games and the like were included. The majority (8) played games at least once a week. Four of them played almost every day. The last two played at least once a month or less than once a month. No-one replied they never play games. Different kinds of games were represented, especially puzzle games, which was favoured by six respondents. All the replies are represented in Figure 23 (on the left). Next, it was inquired, what kind of

activities were enjoyed most in games. The top three activities seemed to be achieving (levelling up, completing goals) with seven references, exploring the game world by five and competing against others by five. All the replies are seen in Figure 23 (on the right).

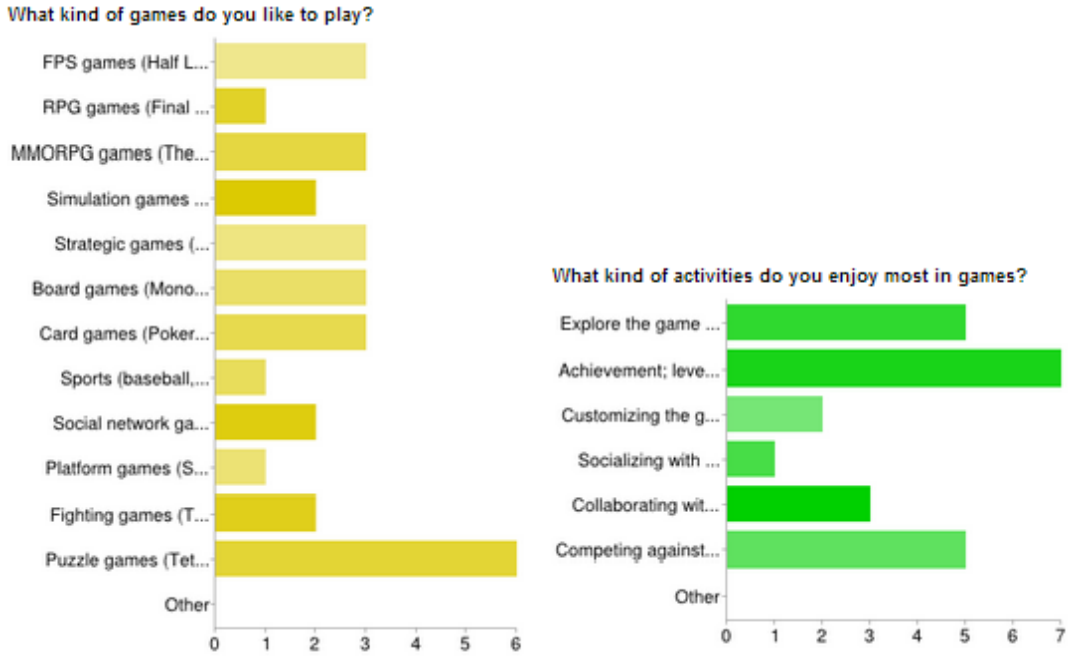


Figure 23: Responses to what kind of games were preferred (on the left) and responses to what kind of activities were enjoyed most (on the right).

The third part inquired attitudes towards current work, and how the employees would feel about combining work and play. This segment was a little tricky, because employees might not feel like they are in the position to give honest feedback to the employer. If your employer asks, if you find your job important, you're likely to say yes out of fear of losing your job. These possible fears were addressed by trying to emphasize, that the results are anonymous, and the subject of review was not the worker. Even still, these results should be dealt with critique. The results will be gone through one by one here, with additional comments. The main question was ”Do you agree with these statements?” with five choices from 1 (disagree) to 5 (agree).

There were five statements that measured how employees feel about working on microtasks. Two statements tried to see if combining work and play is seen as a good or a bad thing. Rest of the statements focused on different things.

Statements ”I find working on microtasks boring” vs. ”I find working on microtasks fun” inquired how enjoyable work is at the moment. The majority disagreed with microtasks being boring, and agreed with microtasks being fun. The answers don't completely mirror each other (in Figure 24), but it seems like working on microtasks is somewhat fun already.

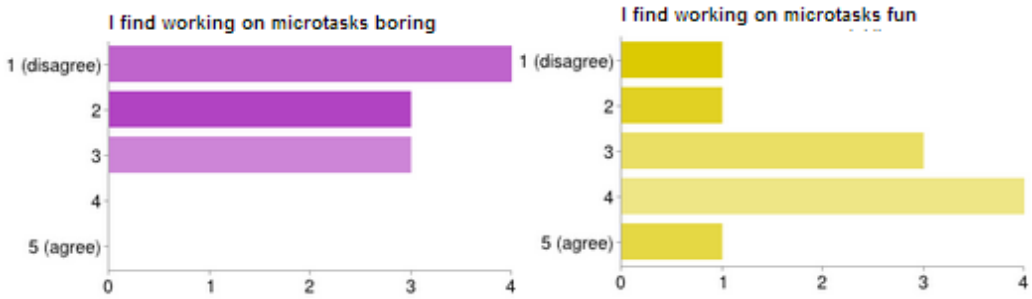


Figure 24: Answers to statements "I find working on microtasks boring" (on the left) and "I find working on microtasks fun" (on the right).

Statements ”Task packages feel too long” vs. ”I don't notice the passage of time when working on microtasks” basically measured the same thing as the previous statements, but in a different way. These two statements should mirror each other as well (in Figure 25), unless they were understood differently. The majority felt that task packages feel too long, but on the other hand passage of time wasn't noticed by the majority.

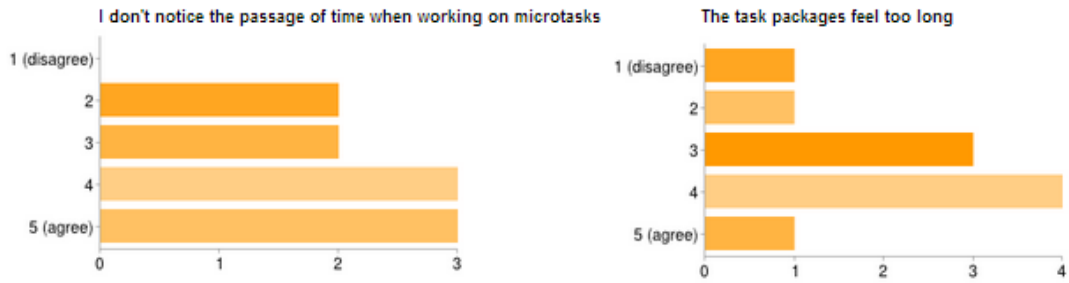


Figure 25: Answers to statements "I don't notice the passage of time when working on microtasks" (on the left), and "The task packages feel too long" (on the right).

Statements ”Work and play don't belong together” and ”I wish working on microtasks would be more fun” measured how the employees would feel about combining work and play. There is a concern that some may find it offensive, and feel like it diminishes the importance of their work. The majority seem to think work and play do belong together (see Figure 26 left side) and the majority also wished working on microtasks would be more fun (see Figure 26 right side). These results suggest that most employees wouldn't have issues with gamified microtasks.

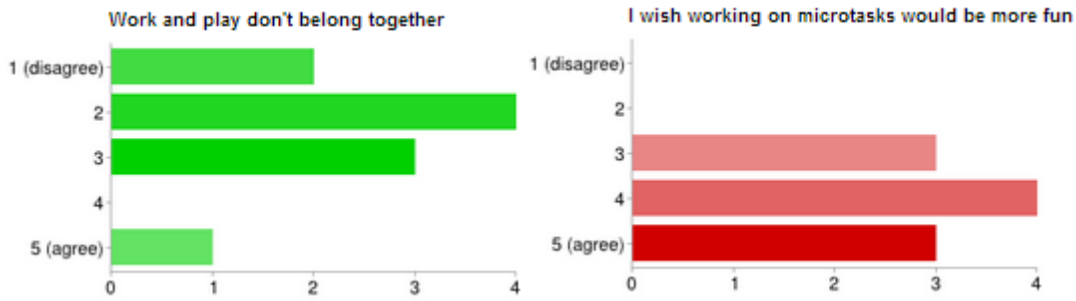


Figure 26: Answers to statements "Work and play don't belong together" on the left and "I wish working on microtasks would be more fun" on the right.

The next statement was ”Working on microtasks is difficult”. The majority disagreed with it (see Figure 27 bottom left). The idea was to see the perceived difficulty of microtasks, which will affect the design of the gamified version.

Feedback is often linked to gamification as a game element, because in games, immediate and constant feedback is always present. It is also something that may motivate workers (like it motivates players). Four agreed and four were neutral about the statement ”I get enough feedback about my work” (see Figure 27 top left). The results suggest that feedback hasn't been a major issue.

The statement ”I solve microtasks sometimes with my co-workers” was meant to see if there is any collaboration at the moment, and if it could be improved. Three disagreed, four were neutral, and three agreed (see Figure 27 top right). It seems like there is some collaboration.

The statement ”I think my work is important” was meant to see if the employees feel like their work adds to something and if that something seems important. Everyone agreed on this (see Figure 27 bottom right).

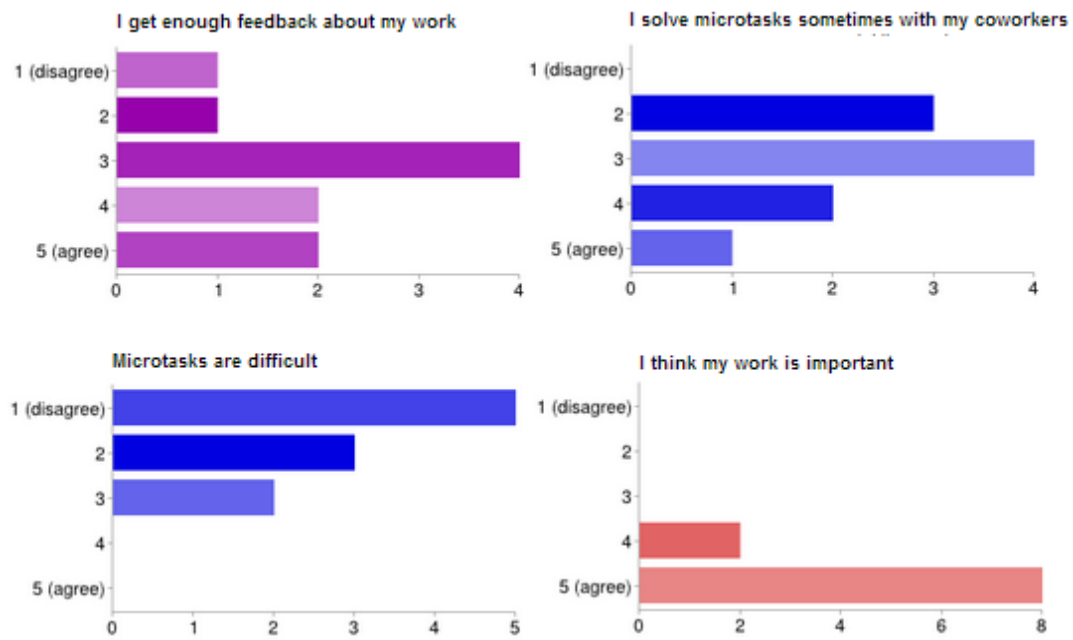


Figure 27: Rest of the responses for statements "I get enough feedback about my work" (top left), "I solve microtasks sometimes with my coworkers" (top right), "Microtasks are difficult" (bottom left) and "I think my work is important" (bottom right).

There were a few comments as well, for example, one requested some kind of scoring system, which would make the application challenging and competitive for gamers. One directly commented that ”*it would be nice to mix work and games to take away a bit of strain from working long hours”*. Another one also commented that ”*This would be fun, I don't think this was done before”*.

The results in general have some issues, but overall it seems like attitudes are positive towards gamification. Also, getting information about gaming habits helps to make some design decisions when implementing the gamified version of DWA.

6.3. Design and Implementation of the Gamified System

This section introduces the design and implementation of the gamified DWA. Subsection 6.3.1 introduces the design concepts, and Subsection 6.3.2 showcases the implemented system.

6.3.1. Design of the gamified system

Microtask had experimented with game-like features before, for example, in Digitalkoot. The firm had followed the GWAP output-agreement game template, but encountered problems with pairing the players and giving feedback. Since there usually wasn't enough players, having a bot would slow down the performance, when efficiency is valued. Therefore, giving feedback on time proved difficult without other players. In the Mole hunt -game the feedback was given at the end of the game field. Even then, not all replies could not be checked, because not all replies were verified by another player. In Mole bridge-game faster feedback was required, so pre-validated tasks were inserted in the game. It worked well, but if, say, 25% of tasks are pre-validated, it reduces the performance of the work significantly. Giving feedback turned out to be very difficult and time-consuming, so instead of giving feedback, an achievement system with badges started to develop. The achievement system was not implemented however. Basically, feedback cannot be given in real time, and the design of the gamified system shouldn't interfere with the performance of the workers.

First, it was checked whether gamification is suitable for the business problem (improving worker accuracy and efficiency). Figure 28 indicates where gamification could be targeted in, in this context.

	core	unique	expanding skills
in role behaviour			most impact
organizational behaviour	most impact		

Figure 28: Gamification for Microtask [Williams and Smith, 2009].

The gamified version will be available for employees, who already solve microtasks as a part of their job. Therefore, it is in role behaviour for them. Focusing on core or unique skills is irrelevant, because they offer nothing new. Instead, as learning is fun, the focus should be on expanding skills. Workers usually want to improve their skills in order to make their job easier, so it is natural to focus there. From an employer's perspective it also makes sense to have employees who do their job (increasingly) well.

Next, the takeaways from the employee questionnaire about playing habits and attitudes give some hint as to what might suit them. All of the workers played more or less, almost all enjoyed puzzle games, and the favourite activities were achievement and competition. As it has been pointed out, competition is something to be careful about in the workplace. I shall use only competition as competition against oneself. This ties into achievement and self-improvement. The work of solving microtasks was then translated into game concepts, which are introduced next.

Tasks are puzzles with varying difficulty. Every microtask is already in a way a puzzle, because the workers might have to decipher very unclear handwriting. Tasks might be in a different language and include unknown characters to the worker. For example, the Scandinavian letters 'å', 'ä', and 'ö' are not used in the English language. In the system, every task already has an 'intrinsic' difficulty level. Task levels are determined partly by task family difficulty. This level is made known, ranging from easy to nightmare. Task difficulty levels are easy, medium, hard, and nightmare. An example of an easy and hard task are shown in Figure 29.

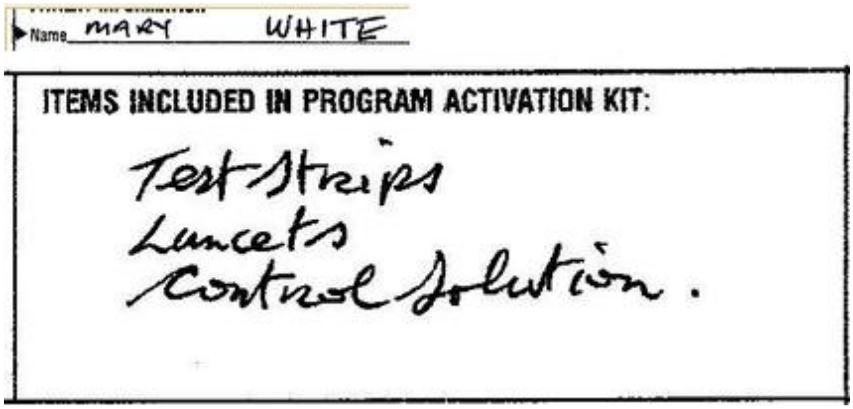


Figure 29: Microtasks. Mary White (on top) is considered to be easy, while the list of items in program activation kit (bottom) is considered to be hard.

Workers' **'player journey'.** In every game, there is a path from a beginner to master. It can be very explicit, like in RPG games, but usually it is implicit. The same goes for the work environment; workers need to learn their job in order to do it. Workers are given status per task family, ranging from novice to master. This is made to acknowledge the experience level of the worker in specific task family. It might motivate novice to get more experience and the experienced should see that they are valuable employees. Attaching the skill level to the task family has at least two benefits; it ensures that there is no end to the player journey (work will continue even after player reaches master level), and it gives more accurate information on what the worker is good at (compare typing phone numbers to foreign names). The ranks are novice, apprentice, adept, expert, and master.

Levelling up. Since we cannot know if the tasks are correct right away, we cannot give any feedback on them before an independent party (for example, the client) has

validated the results. Once the results have been validated, the worker receives *skill points* based on the tasks he or she has solved. The skill points are determined by how difficult the tasks have been. As an example, consider the following: there has been an easy task worth 10 points, a hard task worth 50 points and one nightmare task worth 100 points. The worker has solved the easy and hard tasks, which will give him or her 60 skill points. The amount of tasks made are summed with skill points, which total towards upping the player's skill level in the task family. If the player/worker has made three tasks, his or her total is 63 points. When the points break certain thresholds, the worker moves up a skill level in the task family. The thresholds are dynamically determined, because each worker is an individual with varying skill levels. Whenever the worker accumulates skill levels, he or she also gains an *experience level*, which is a never ending running number.

Achievements. Games often contain achievements for the player to achieve, like clearing a level without raising the alarm. There are also possibility of achievements in the workplace; a colleague might be recognized for his or her ability to see what others have missed. In the gamified version of working on microtasks, achievements reflect especially good performance or skills in some kind of tasks. For example, solving 20 microtasks within 30 seconds, having the best score in a certain task package, or solving a task with the rank nightmare.

I had an idea of introducing some kind of collaboration between workers, so they could help each other solve tasks. There could have been a possibility to ask another worker what they think about some task, and get some kind of collaboration bonus. Another idea was to introduce small distractions during work, for example showing a joke to the worker. There could've also been information about the client order overall, by showing how much has been completed and how much is left. It would've tied into relatedness (part of intrinsic motivation), which might have motivated the workers. It would have been possible to give direct feedback based on the verification tasks scattered in task packages. The mascot of Microtask could have showed up during work flow and comment the performance, based on the verification tasks. These ideas were not implemented, however, in the limits of this thesis.

6.3.2. Gamified DWA

Task family specific statistics collection had to be created in order to implement the game-like features. The information derived from the statistics is the basis of gamification in software engineering point of view. In this case the statistics and game-like features are not a part of the system's function, which is why they need to be kept separate and light-weight so they don't interfere with the system's operation. In the gamified version the worker's basic workflow remains unchanged. Figure 30 shows the dashboard after the worker has completed his or her first qualification test. First three achievements are granted after this automatically as a tutorial on what the gamified system is about.

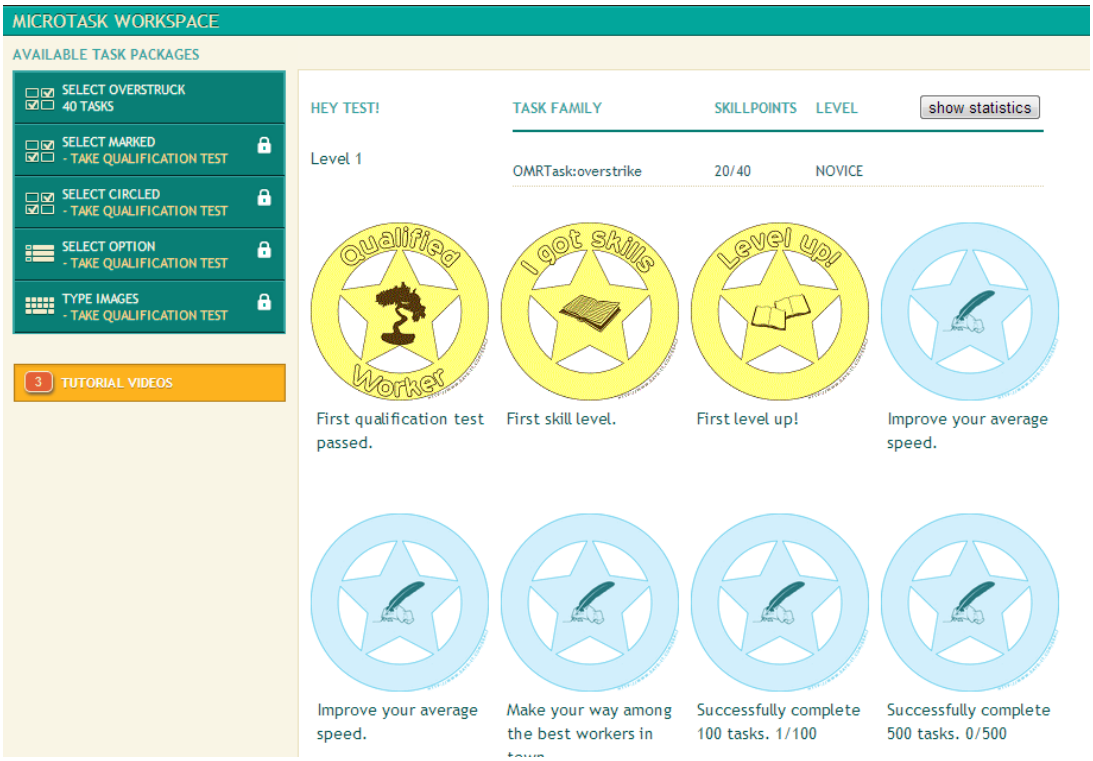


Figure 30: Screenshot of gamified dashboard.

Top left of Figure 30 shows the worker's experience level, and the top right shows the task family specific skill level. Here we can see that the worker is level 1, he or she has unlocked one task family and is a novice at it. The bottom shows all the completed and uncompleted achievements. The achievements are the kind that encourage the worker to try work more efficiently or they can be surprising. For example, if the worker manages to get the max amount of skill points he or she will earn an achievement for that.

Figure 31: The statistics in detail.

The worker has a chance to see on what his or her skill points are determined of as shown in Figure 31. This is meant to add trust and transparency in the system. The first column shows how many tasks the worker has received and how many have been successfully completed in general. The second one tells how many tasks are pending review. Easy, medium, hard, and nightmare columns inform how many of the tasks have been in different categories, and how many have been successfully completed. It is also counted how many tasks per minute the worker has completed in average. All this information is tied into different time windows, which can be specified to be any period of time, for example a week. The time windows enable more specific statistics, and provide the possibility to compare worker performance by time and task family more accurately.

7. Conclusions

The trend called gamification has been examined in this thesis by surveying the theories it's connected to and by conducting a small case study. The emphasis has been on how to gamify a system, and what does gamification mean for enterprises.

GWAPs and productivity games have shown that gamification can be very beneficial for work-related activities. It's important to note that projects like Google Image Labeler and Language Quality game were both completely voluntary. They also had a lot of players or employees to participate in them. At the time of preparing this thesis, our case study enterprise had ten employees in total working on microtasks. Solving microtasks was also their job, and hence, in this case gamification was not related to a voluntary activity. Gamification presumably works in this context if it's meant to be about enhancing worker skills, and making the work more enjoyable. If solving microtasks becomes more open to the public in the future, gamification would suit it very well. A good example of such projects was Digitalkoot.

The problematic issue in gamifying the work in the case study was the small number of workers. Using pairs or groups like in GWAPs for immediate feedback wasn't possible, because often there might be just one worker actively solving tasks, and the same tasks were sent to just one or two workers tops. Because the tasks were usually solved by one worker, there was no way to determine its difficulty either. A hard task would have gathered many different responses if it were sent to multiple persons. Most of workers were already experienced at their job. Gamified system might have been efficient with new workers, assuming they would have had the chance to increase their skills from 'zero level'. Experienced workers were already solving tasks with good performance.

Among other limitations is the fact that well designed gamification of a system is beyond the scope of the thesis as it involves play testing and iterations, and a team of more than one person to design it.

Although gamification is a relatively new area of research, it is growing rapidly. The success stories of Foursquare and the like are possibly due to the public being excited about something they had not encountered before. It is possible people will get tired of gamified systems when they encounter them more, especially with behaviourist standpoint gamification. Therefore having a narrow achievement system might not have the desired effect. Furthermore, games are known to either succeed or fail. Out of all the games created, only a handful are actually profitable. It is likely that this kind of hit and miss nature will follow gamified systems.

There are some lessons learned from the case study. The technical basis of gamification is on statistics. The system needs to observe and track the user in order to give accurate feedback. Giving accurate feedback is especially important in gamification that is focused on skill development. Each user develops in his or her own pace from different starting points, so the feedback has to be dynamic. The activities involved in

gamification should be kept separate from the system's primary operations. Ideally, it shouldn't interfere with the system much at all. It also directs attention to user experience. As usability is focused on making things run as smoothly as possible for the user, gamification aims to motivate and affect the user otherwise by giving incentives to do something.

Market forecasts show that gamification will be more and more popular especially in enterprises. It's likely there will be success stories, but most will fail. The systems can be manipulative and shallow, or empowering and thoughtful. When it comes to user experience, it is impossible to say which the system is from a designer viewpoint. For example, the system created in the case study might feel manipulative to others and encouraging to others. When it comes to how people perceive things, the topic area approaches psychology, which is in itself a relatively new area of research.

Whatever happens to gamification as a term or otherwise, it has brought a new way of thinking about systems. It's not just about social media, visiting the online bank, or searching for information. All of a sudden people might spend time on a site for its own sake, because they find it fun and encaging. And this site can affect their behaviour, like encouraging them to exercise more. Computer systems are no longer passive means of communication, but active participants in human-computer interaction.

With this new window of opportunities opened, the ethical side of software engineering becomes ever more important. Designers must think how they want to influence the users and whether the way is morally right.

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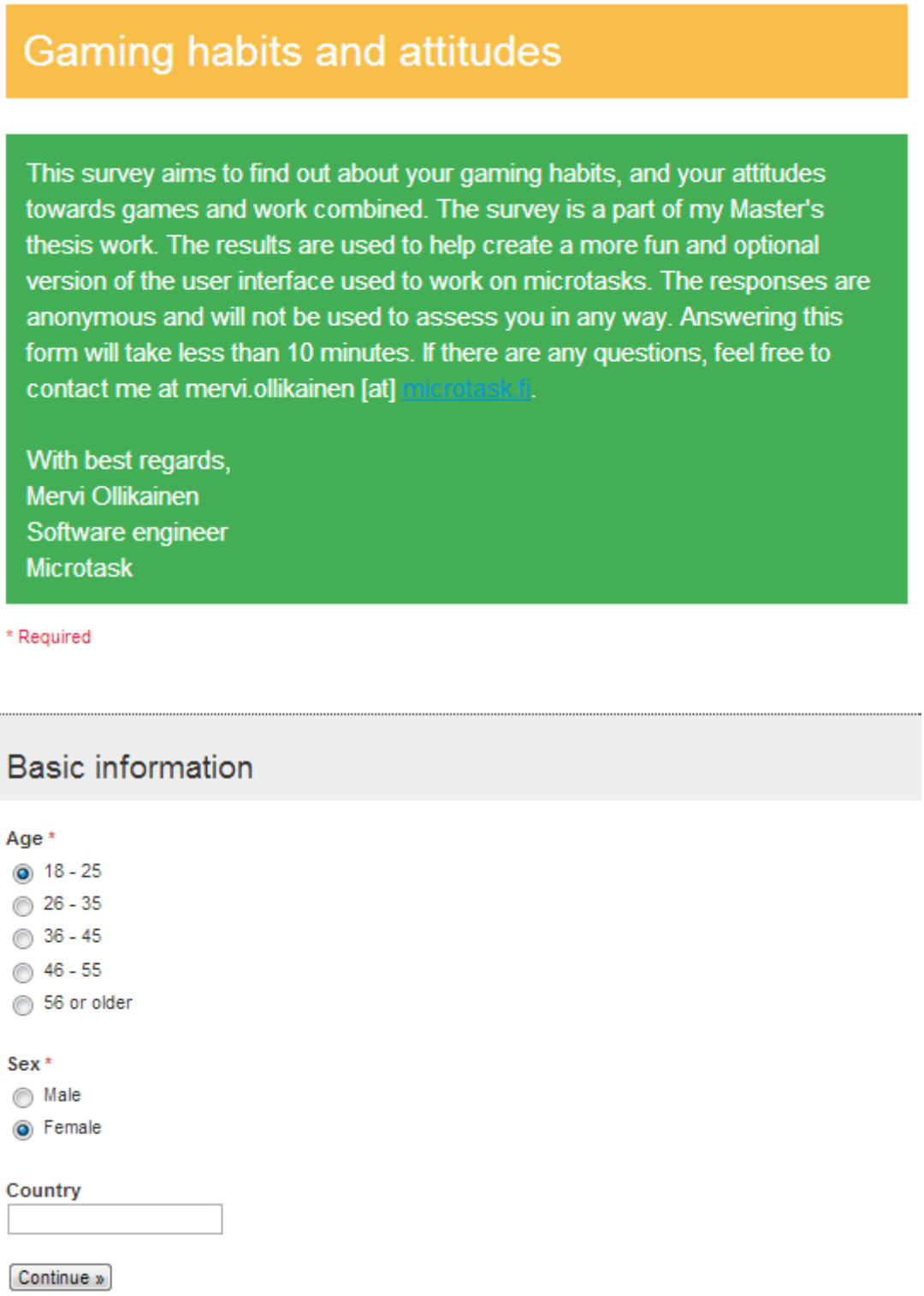
Appendix A: The survey

This employee survey was used to find out what kind of gaming habits the target group had, and how they feel about combining work and play.



Gaming habits and attitudes

This survey aims to find out about your gaming habits, and your attitudes towards games and work combined. The survey is a part of my Master's thesis work. The results are used to help create a more fun and optional version of the user interface used to work on microtasks. The responses are anonymous and will not be used to assess you in any way. Answering this form will take less than 10 minutes. If there are any questions, feel free to contact me at mervi.ollikainen [at] microtask.fi.

With best regards,
Mervi Ollikainen
Software engineer
Microtask

* Required

Basic information

Age *
- 18 - 25
- 26 - 35
- 36 - 45
- 46 - 55
- 56 or older

Sex *
- Male
- Female

Country

Continue »

Gaming habits and attitudes

Gaming habits

These questions aim to find out about your gaming habits, e.g. what kind of games you like to play, how often, what do you like about them.

How often do you play games?

This includes video games, social network games e.g. Farmville, sports e.g. football, board games and card games.

- ◯ Never (Continue to next page)
- ◯ Less than once a month
- ◯ At least once a month
- ◯ At least once a week
- ◯ Almost every day
- ◯ Every day

What kind of games do you like to play?

You can choose several.

- ☐ FPS games (Half Life, Call of Duty...)
- ☐ RPG games (Final Fantasies, Fallout, Skyrim...)
- ☐ MMORPG games (The World of Warcraft..)
- ☐ Simulation games (The Sims, Forza Motorsport..)
- ☐ Strategic games (Civilization, Sim City..)
- ☐ Board games (Monopoly, Scrabble..)
- ☐ Card games (Poker, Solitaire..)
- ☐ Sports (baseball, football, soccer, dodgeball, basketball..)
- ☐ Social network games (Farmville, Cityville..)
- ☐ Platform games (Spyro, Jack and Daxter..)
- ☐ Fighting games (Tekken..)
- ☐ Puzzle games (Tetris..)
- ☐ Other: [ ]

What kind of activities do you enjoy most in games?

In other words, what do you like to do in the game world?

- ☐ Explore the game world
- ☐ Achievement; leveling up, completing goals
- ☐ Customizing the game world and the game character(s)
- ☐ Socializing with others; chatting
- ☐ Collaborating with others; achieving a goal in a team, gifting
- ☐ Competing against others
- ☐ Other: [ ]

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Gaming habits and attitudes

* Required

Games and work

These questions aim to find out about your attitudes towards combining games and working on microtasks. Remember the answers are anonymous and will not be used to review you. It is also important to note that the more game-like version of making microtasks will be completely voluntary. You can always choose to use the current interface.

Do you agree with these statements? *

	1 (disagree)	2	3	4	5 (agree)
I find working on microtasks boring	○	○	○	○	○
Microtasks are difficult	○	○	○	○	○
The task packages feel too long	○	○	○	○	○
I wish working on microtasks would be more fun	○	○	○	○	○
I find working on microtasks fun	○	○	○	○	○
Work and play don't belong together	○	○	○	○	○
I get enough feedback about my work	○	○	○	○	○
I solve microtasks sometimes with my coworkers	○	○	○	○	○
I don't notice the passage of time when working on microtasks	○	○	○	○	○
I think my work is important	○	○	○	○	○

Any additional comments, suggestions or ideas?

Type freely your own opinions regarding this survey and mixing work and games.

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